CONFIDENTIAL

Bendix Commercial Vehicle Systems
Elyria, OH 44036

PRODUCT SPECIFICATION BW-283-PR

ANTILOCK BRAKING SYSTEM

TABS6 STANDARD & PREMIUM MODEL

TRAILER ABS MODULE

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1 Scope

This document provides technical information about the function, performance, and installation requirements of the Bendix Trailer Antilock Brake System (ABS) Module, referred to as TABS6. It is important to read this information to ensure the best performance and safety of the ABS system.

1.1 Description

The technical information included in this document explains the function and operational requirements of the TABS6 in detail. Brief explanations of the other system components are included along with references to their individual specifications. Service and installation instructions are also included in this document.

1.2 Specifications

1.2.1 Bendix Commercial Vehicle Systems Specifications

BW-120-A	Application	Wheel Speed Sensor Customer Interface Recommendations
Y0018267_EN	Design	TABS6 SAE J1587 & SAE 2497 - Public Proprietary Commands and Parameter Identifiers
Y0018268_EN	Design	TABS6 SAE J1587 & SAE 2497 - Parameter Descriptions
BW-196-PR	Product	SR-5 Trailer Spring Brake Valve
BW-260-PR	Product	WS-24 Variable Reluctance Wheel Speed Sensor
BW-269-PR	Product	WS-24 Wheel Speed Sensor Clamping Sleeve
BW-284-PR	Product	Trailer Remote Diagnostic Unit (TRDU)
SD-13-4767	Service	TABS6 ABS Module
5014015	Drawing	TABS6 ABS Module
5015013	Drawing	TABS6 Standard ABS Pigtail Harness
5015018	Drawing	TABS6 Premium ABS Pigtail Harness
6000365	Drawing	Wheel Speed Extension Cable
5013343	Drawing	Remote Modulator Extension Cable
5007833	Drawing	Diagnostic Extension Cable

1.2.2 SAE Documents

SAE J400	Test for Chip Resistance of Surface Coatings
SAE J560	Seven Conductor Electrical Connector for Truck-Trailer Jumper Cable
SAE J1113-13	Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Immunity to Electrostatic Discharge
SAE J1455	Joint SAE/TMC Recommended Environmental Practices for Electronic Equipment Design (Heavy Duty Truck)
SAE J1587	Electronic Data Interchange Between Microcomputer Systems in Heavy-Duty Vehicle Applications
SAE J1708	Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications
SAE J2497	Power Line Communications for Commercial Vehicles

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1.2.3 Government Documents

FMVSS 121	Department of Transportation, National Highway Traffic Safety Administration Federal Motor Vehicle Safety Standard 571.121

1.2.4 Standards

RP-1210A	TMC Recommended Practice for Windows™ Communications API
RP-137A	TMC Recommended Practice for ABS Electrical Supply from Tractors through the SAE J560 Seven-Pin Connector
RP-141	TMC Recommended Practice for Trailer ABS Power Supply Requirements

1.2.5 Abbreviations and Symbols

ABS	Antilock Brake System
ADL	Auxiliary Design Language
AUX	Auxiliary
DTC	Diagnostic Troubleshooting Code
ECU	Electronic Control Unit
EEPROM	Electrically Erasable Programmable Read-Only Memory
EOL	End-Of-Line
ESD	Electrical Static Discharge
FMVSS	Federal Motor Vehicle Safety Standard
I/O	Input / Output
ISS	Integrated Speed Switch
LED	Light Emitting Diode
MOD	Modulator
MPH	Mile Per Hour
MRV	Modulator Relay Valve
NPT	National Pipe Thread
OEM	Original Equipment Manufacture
PC	Personal Computer
PLC	Power Line Communication
RF	Radio Frequency
RP	Recommended Practice
RPS	Revolutions Per Second
RT	Room Temperature
RTR	Reset To Ride
SAE	Society of Automotive Engineers
SAL	Sensor – Additional Right
SAR	Sensor – Additional Left
SL	Sensor – Left
SR	Sensor – Right
TABS	Trailer Antilock Brake System
TMC	Trailer Maintenance Council
TRDU	Trailer Remote Diagnostic Unit
UV	Ultra-Violet
VAC	Voltage – Alternating Current
VDC	Voltage - Direct Current
VIN	Vehicle Identification Number
WSS	Wheel Speed Sensor

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2 General Product Description

2.1 Trailer Antilock Braking System (TABS)

The *Bendix*® TABS is an electronic system that prevents wheel lock-up during braking to maintain optimal vehicle steer-ability and stability, as well as minimizing stopping distance.

The TABS intervenes during braking whenever the available friction between the road and the tire of a monitored wheel is less than the braking force applied to the wheel causing the wheel to decelerate (impending wheel lock) quickly.

The system consists of the following components:

- Electronic Control Unit (ECU) monitors the speed sensor signals and determines when ABS intervention is required. It then actuates the appropriate pressure modulator valves to optimize the brake pressure. The ECU continually monitors the system to detect and warn the driver of any malfunctions. Diagnostic Troubleshooting Codes (DTC) are stored in the ECU and can be recalled to diagnose a failure.
- Wheel Speed Sensors (WSS) located at the wheels to sense the instantaneous movement of individual wheels and to send an electrical signal directly proportional to the rotational velocity of the sensed wheel to the electronic control unit.
- Modulator Relay Valves (MRV) located near the brake chambers and are controlled electrically by the ECU to decrease, hold or allow the full applied brake pressure into the brake chamber to control the braking torque at the wheels.
- Trailer ABS Warning Lamp is controlled by the ECU as required to indicate ABS status. The trailer ABS warning lamp will illuminate when ignition power is applied to the ECU, and extinguish after a lamp check is performed if there are no ABS faults present.

2.2 ABS Control Modes

Several ABS control modes can be utilized for monitoring and controlling the individual wheels of the trailer. The possible modes are:

- Axle Control: TABS axle control will utilize a single ABS modulator-valve to control wheels from both sides of a given axle or axles. In the case of an unbalanced braking surface, axle control will control the high coefficient wheel just under the lock limit. Temporary periods of wheel lock are permitted on the low coefficient wheel. Axle control should not be used on fifth wheel dollies or steerable axles. When braking on even surfaces, an axle-control system will perform similar to a side control, two-modulator system. Axle control is available in 2S/1M, 2S/2M and 4S/2M installations.
- Dolly-Axle Control (Select Low): TABS dolly-axle control will utilize a single ABS modulator-valve to control wheels from both sides of a given axle or axles. In the case of an unbalanced braking surface, dolly-axle control will control the low coefficient wheel just under the lock limit. Optimal vehicle stability is achieved by not allowing the high coefficient wheel to sustain wheel lock. When braking on even surfaces, a dolly axle control system will perform similar to side control or axle control system. Dolly axle control is only available in 2S/1M installations.

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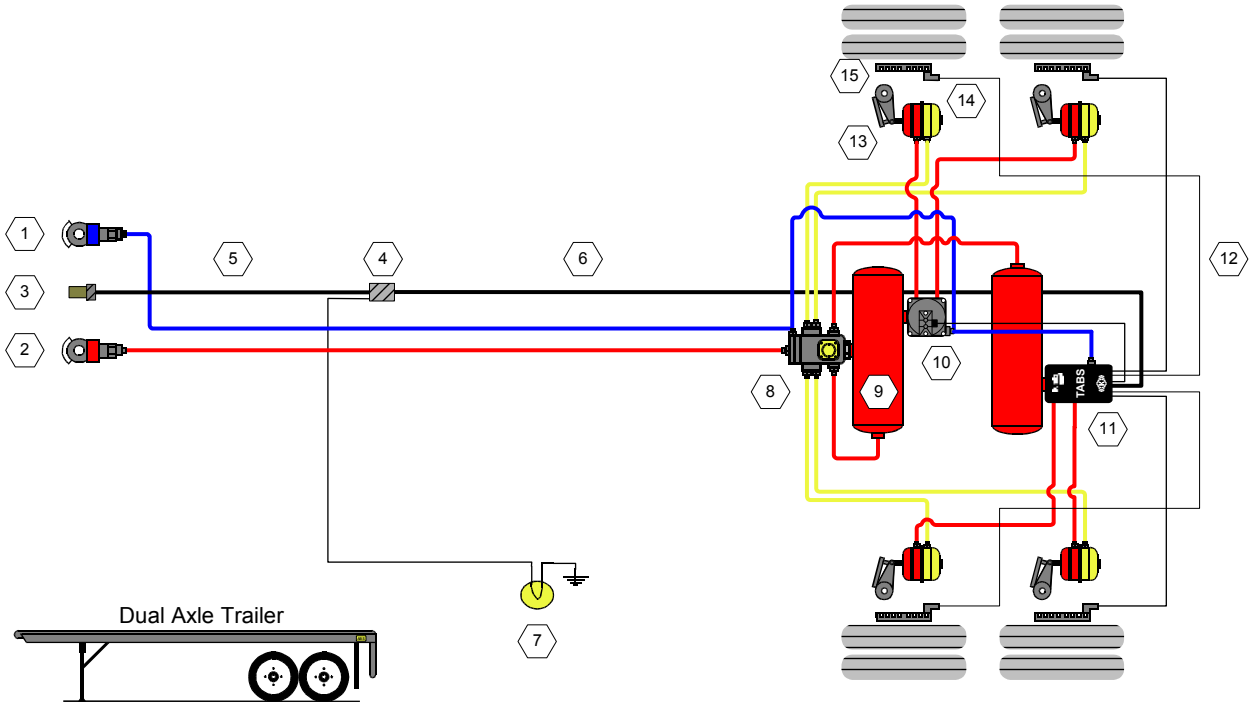
- Side Control: TABS side control will utilize a single ABS modulator-valve to control one or more wheels on a given vehicle side. In the case of an unbalanced braking surface, TABS side control will individually control each side just under the lock limit. Side control is available in 2S/2M, 4S/2M and 4S/3M (3rd modulator in axle control) installations.
- Normal Braking: During normal braking, the TABS will function as a standard relay valve. As brakes are applied or released by the driver, the control signal from the tractor foot valve causes the Modulator Relay Valve to apply proportional pressure to the trailer brake chambers.
- ABS Fail-safe: The TABS is designed to react in a fail-safe manner in event of a system fault. If an ABS system fault occurs, the TABS ECU will illuminate the trailer ABS warning lamp and revert to standard pneumatic brake function.

2.3 ABS Vehicle Installation Schematic

Figure 1 illustrates an example of a component configuration of the 4S/2M ABS installation on a 2-axle trailer. Two (2) wheel speed sensors (2S) and two (2) modulator relay valves (2M) are used in this component configuration.



1. Glad Hand - Service
2. Glad Hand - Supply
3. 7-Pin Connector – SAE J560
4. 5-Pin Connector - ABS
5. Trailer Chassis Harness
6. ABS Pigtail Harness
7. Trailer ABS Warning Lamp
8. Spring Brake Valve
9. Service Reservoirs
10. Modulator Relay Valve
11. Trailer ABS Module
12. Wheel Speed Extensions
13. Spring Brake Chambers
14. Wheel Speed Sensors
15. Exciter Rings

Figure 1: General Schematic of a Trailer ABS in 4S/2M Configuration

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3 System Components

3.1 TABS6 Trailer ABS Module

The TABS6 is a modular-approach to a trailer ABS assembly, in which the Electronic Control Unit (ECU) and the Modulator Relay Valve (MRV) are integrated into a single self-contained 2S/1M-trailer ABS unit. The TABS6 design offers the following features:

- Internal electrical connections to the primary MRV, eliminating the need for any external pigtail harness for this modulator.
- The sealed ECU includes a pressure equalizer valve to improve the robustness against water ingress.
- A locking dust cover is provided additional electrical connector and cable protection.
- A serviceable nylon filter to prevent foreign material larger than 0.013 inches from entering the control port of the TABS6.
- Provisions mounting the TABS6 either directly on the service reservoir (tank-mount) or on the chassis (frame-mount) without requiring any additional brackets.
- Available in two- (2) models; Standard TABS6 with only 2S/1M configuration and Premium TABS6 with a default 2S/1M configuration, auto-configurable up to 4S/3M.

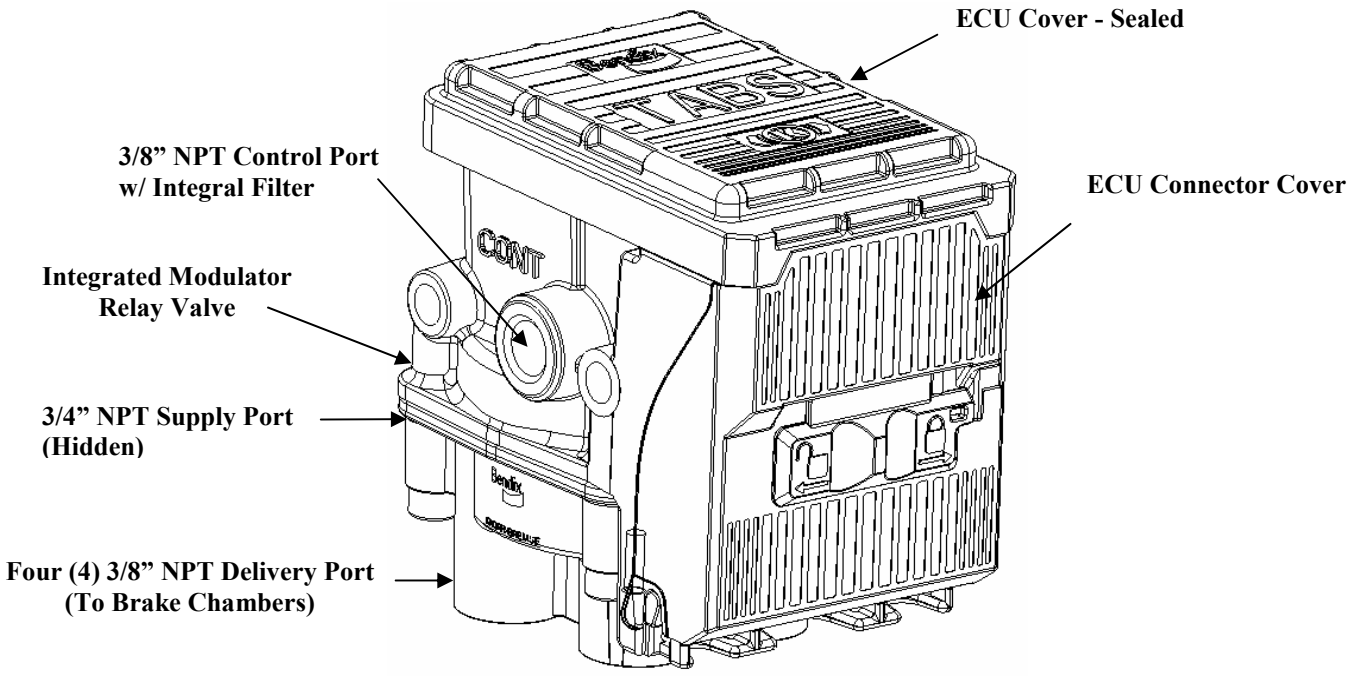

Figure 2: TABS6 Module Design

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TABS6 Model	Bendix Offering	ABS Configuration & Control Mode	Blink Codes	J2497 (PLC)	J1587 Diag	Aux pins available
Standard	Option #1	2S/1M – Axle	Yes	Yes	No	1
	Option #2	2S/1M – Dolly Axle	Yes	Yes	No	1
Premium	Option #1	2S/1M – Dolly Axle (Default)	Yes	Yes	Yes	6
		➥ 2S/2M – Side	Yes	Yes	Yes	4
		➥ 4S/2M – Side	Yes	Yes	Yes	4
		➥ 4S/3M – Side, Axle	Yes	Yes	Yes	1
	Option #2	2S/1M – Axle (Default)	Yes	Yes	Yes	6
		➥ 2S/2M – Axle	Yes	Yes	Yes	4
		➥ 4S/2M – Axle	Yes	Yes	Yes	4
General Specifications	• Size: 5.9” Height x 5.9” Width x 4.1” Depth • Weight: 4.2 lbs • Voltage range: 8 to 16 VDC • Temperature range: -40 °F to + 185 °F (-40 °C to +85 °C) • Maximum current draw: - ABS active (1 mod): 3.7 amp @ 12 VDC @ RT - ABS active (2 mods): 5.2 amp @ 12 VDC @ RT • Mounting provisions: - Tank-mounted: ¾”-14 NPT Heavy wall steel nipple ▪ Swing radius: 4.75” R - Frame-mounted: Two-(2) through holes for Grade 5 3/8-16 bolts, typical length 5” ▪ Torque: 180 – 220 in-lbs					
Standard Features	• Modular design: - Integral ECU & modulator relay valve • Integral ECU connectors: - Sensors (both): Separate DIN connectors - Standard unit: 5-Pin Packard Weatherpack Connector - Premium unit: 18-Pin Deutsch Connector • Auxiliary ECU pins available: - Standard unit: One (1) ECU pin - Premium unit: Up to six- (6) ECU pins • Custom auxiliary functions via Auxiliary Design Language (ADL) • Electronic odometer w/ trip counter & service interval options • User Read/Write Capability (Scratchpad) - Up to 756 bytes of freely definable text space available. - Option to configure an additional area of 252 bytes, if needed. • Integral nylon control line screen (serviceable)					
Diagnostics	• Blink Codes – Trailer-mounted ABS lamp: - Ignition “ON” & brake pedal toggle - Displays: ▪ Active Faults ▪ Fault History ▪ System Configuration ▪ Odometer • Supports SAE J1587 PC Diagnostics: - SAE J2497 (PLC) - SAE J1587/J1708 connector (Premium unit only) - Bendix ACOM4 PC Diagnostics: ▪ Automated End of Line test ▪ Dynamic data collection ▪ Automatic access to all service data literature					

Table 1: TABS6 Module Part Numbers & Features

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3.1.1 Modulator Relay Valve (MRV) Crack Pressure

The TABS6 internal-MRV is available with nominal crack pressure of 3.0 ± 1.0 psi.

3.1.2 Control Line Filter

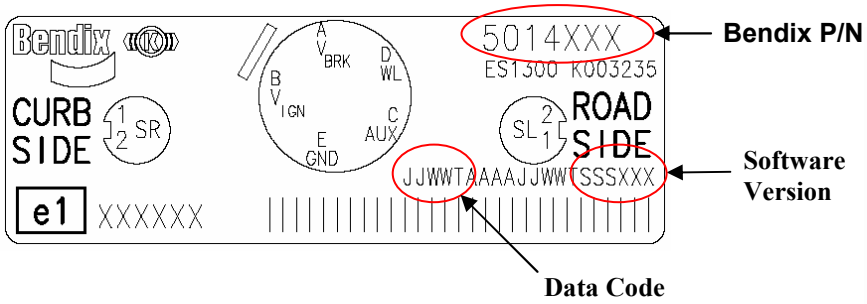
The TABS6 internal-MRV is designed with an integral nylon filter to prevent foreign material larger than 0.013 inches from entering the control port of the modulator relay valve. This filter body is made of nylon and is screwed in place directly in the control line port. The filter is serviceable with a screw-in replacement.

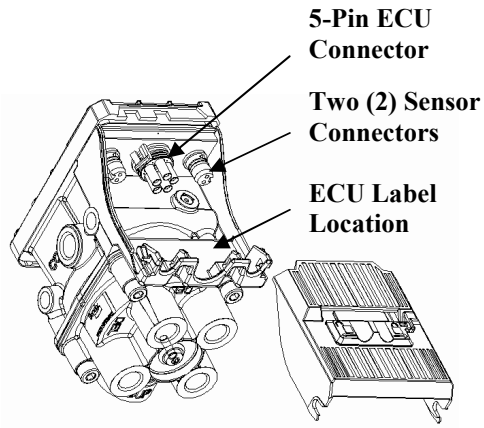
3.1.3 FMVSS 121 Timing

The TABS6 internal-MRV is designed to meet FMVSS 121 timing requirements when installed per Bendix recommended installation guidelines and/or Bendix system drawings. FMVSS 121 timing compliance is the responsibility of the towed vehicle manufacturer.

3.1.4 ECU Identification & Connector Pin-Out

Identification information for the TABS6 ECU is located on the connector pin-out label (refer to Figure 3 and Figure 4). The label is located under the ECU connector cover.





2-Pin Round DIN Sensor Connector		5-Pin Packard Weatherpack Connector		2-Pin Round DIN Sensor Connector	
Pin	**Designation**	**Pin**	**Designation**	**Pin**	**Designation**
1	Sensor Right SR (+)	A	Brake Lamp Voltage	1	Sensor Left SL (+)
2	Sensor Right SR (–)	B	Ignition Voltage	2	Sensor Left SL (–)
		C	Auxiliary (AUX)		
		D	ABS Warning Lamp		
		E	Ground		

Figure 3: ECU Identification & Pin-Out - Standard TABS6

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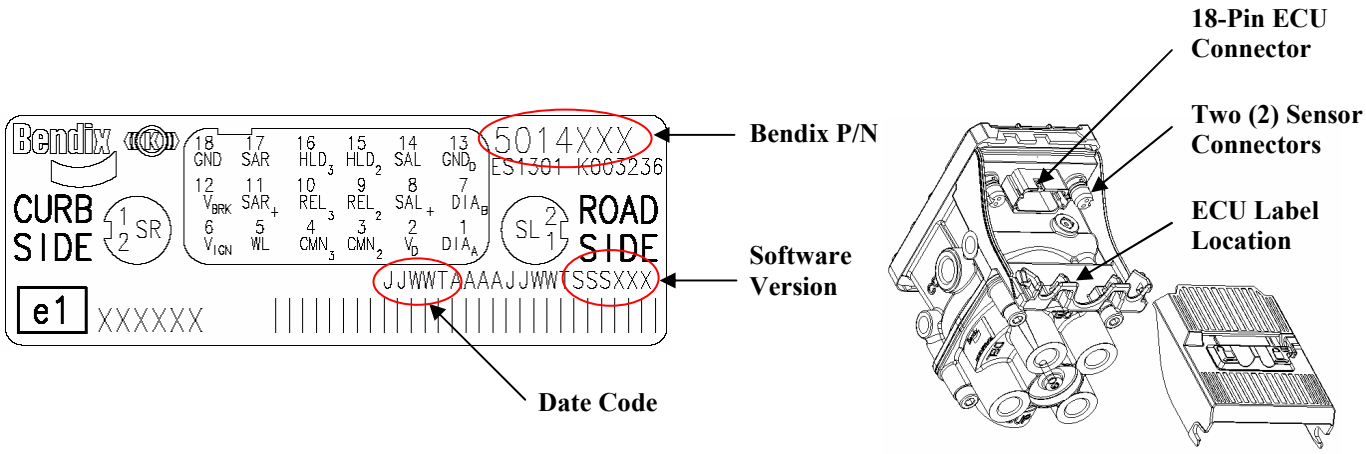

2-Pin round DIN Sensor Connector		18-Pin Deutsch DT Series connector		2-Pin Round DIN Sensor Connector	
Pin	**Designation**	**Pin**	**Designation**	**Pin**	**Designation**
1	Sensor Right SR (+)	1	J1587 (A)	1	Sensor Left SL (+)
2	Sensor Right SR (–)	2	J1587 Voltage (AUX6)	2	Sensor Left SL (–)
		3	MOD2 Common		
		4	MOD3 Common (AUX5)		
		5	ABS Warning Lamp		
		6	Ignition Voltage		
		7	J1587 (B)		
		8	Sensor Additional Left SAL (+)		
		9	MOD2 Release (AUX4)		
		10	MOD3 Release (AUX2)		
		11	Sensor Additional Right SAR (+)		
		12	Brake Lamp Voltage		
		13	J1587 Ground		
		14	Sensor Additional Left SAL (–)		
		15	MOD2 Hold (AUX3)		
		16	MOD3 Hold (AUX1)		
		17	Sensor Additional Right SAR (–)		
		18	Ground		

Figure 4: ECU Identification & Pin-Out - Premium TABS6

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3.1.5 ECU Power Circuit

The power circuit consists of permanent power input, a common ground and a brake light power input for backup as required by FMVSS 121. With constant power, electrical power to the ECU is present whenever the ignition switch is in the “on“ position.

Once a minimum voltage of 8.5 V has been achieved, the ECU will initiate full ABS function at levels between 8 volts and 16 volts. If system voltage is less than 8.5 Volts during the power-up sequence, the warning light will come on until the system voltage reaches this minimum. If the voltage does not reach 8 Volts for 20 seconds, the warning light will stay on and the ECU will set a low voltage fault.

The common ground is shared with the other trailer electrical systems. Brake Light power provides back-up power as well as a power input for older tractors (no provision for permanent power to the SAE J560 connector) to the ECU. Brake Light power is only supplied when the brake pedal is depressed and the stop light switch is activated.

The ECU is protected against the following:

- Reverse Polarity
- Electrical Static Discharge (ESD)
- Load Dump
- Jump Start
- Electrical Transients

3.1.6 Communication Data Links

3.1.6.1 SAE J1587 Diagnostics

The TABS6 Premium ECU provides a data link for diagnostics and is implemented according to the recommended practice of SAE J1587.

The data links are fully compatible with SAE J1708 recommended practice for serial data communications.

3.1.6.2 SAE J2497 PLC Communications

The TABS6 Standard and Premium ECU provides a data link for transmitting information over the power line per the recommended practice of SAE J2497.

PLC is a bi-directional, serial communications link over the ignition power-supply line among electronic devices to transmit and receive messages between a tractor and trailer(s).

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3.1.7 ECU Speed Sensor Input Circuits

The TABS6 ECU speed sensor input circuits are designed to interface with variable reluctance speed sensors as follows:

- Standard: Two (2) sensors - Sensors Left SL & Right SR
- Premium: Up to four (4) sensors - Sensors Left SL, Right SR, Additional Left SAL & Additional Right SAR.

3.1.8 ABS Warning Light Circuit

3.1.8.1 Trailer-Mounted ABS Warning Light via ECU Driver

The trailer-mounted ABS warning light is required by FMVSS 121 until March 1, 2009. The lamp is activated whenever there is a malfunction that effects the generation or transmission of response or control signals in the TABS6 system. The indicator light will remain activated as long as such a malfunction exists, whenever power is supplied to the ABS system.

The trailer-mounted ABS warning light is controlled directly from the trailer ABS ECU by a high-side driver, capable of driving one- (1) 3.0 A load at 12 volts. The trailer ABS warning light displays also outputs blink code diagnostics as presented in Section 0.

3.1.8.2 Cab-Mounted ABS Warning Light via PLC

The TABS6 ECU provides the trailer ABS warning light Information to the driver's cab through PLC communication.

When the trailer ABS warning light information is transmitted via PLC, the tractor ABS PLC ECU controls the trailer ABS warning light that is mounted in the tractor's cab. The control of the trailer warning light can be done by either directly connecting to the light, or by providing an appropriate control message by J1587 or J1939) to another ECU which then controls the light.

SAE J2497 defines the method to activate the trailer ABS warning light that located in the tractor.

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3.1.9 Auxiliary Inputs & Outputs (I/O)

The TABS6 ECU is designed to provide up to five- (5) high-side drivers (power), and one- (1) low-side drivers (ground) for use of auxiliary functions, for additional modulators in a multi-channel ABS system.

Matrix of Available Auxiliary Functions							
Standard	2S/1M	AUX					
Premium	2S/1M	AUX1	AUX2	AUX3	AUX4	AUX5	AUX6
	2S/2M	AUX1	AUX2	AUX3			AUX6
	4S/2M	AUX1	AUX2	AUX3			AUX6
	4S/3M						AUX6

Table 2: TABS6 Auxiliary Input & Outputs (I/O's) Matrix

Name	Model	ECU Pin	Auxiliary Functions	Default Function
AUX	Standard	C	• High-Side Driver… or • Digital Input… or • Analog Input	None
AUX1	Premium	16	• High-Side Driver… or • Digital Input	Modulator 3 (MOD3) Hold Solenoid
AUX2	Premium	10	• High-Side Driver… or • Digital Input	Modulator 3 (MOD3) Release Solenoid
AUX3	Premium	15	• High-Side Driver… or • Digital Input	Modulator 2 (MOD2) Hold Solenoid
AUX4	Premium	9	• High-Side Driver… or • Digital Input	Modulator 2 (MOD2) Release Solenoid
AUX5[1]	Premium	4	• Low-Side Driver… or • Analog Input	Modulator 3 (MOD3) Common
AUX6	Premium	3	• High-Side Driver… or • Digital Input	J1587 Diagnostic Power

Table 3: Standard TABS6 Auxiliary (AUX) Capabilities

Auxiliary Pins AUX, AUX1-4 & AUX6			
Electrical Characteristic	**Min**	**Typ**	**Max**
Load Power, Watts			56
Load Resistance, Ohms	4		2k
Output Current, mA	2.5	3	3.5
Off-State Load Current, mA	0.5	0.8	1
Saturation Voltage, V	0.15	0.2	0.3
Clamping Voltage, V	41	47	52
Pull-up Resistor, Kohms		14.7	
Input Low Voltage, V	-0.4	0	2
Input High Voltage, V	8	12	16

Auxiliary Pin AUX5 Only			
Electrical Characteristic	**Min**	**Typ**	**Max**
Load Power, Watts			112
Load Resistance, Ohms	2.5		500
Output Current, mA	2	5	7
Off-State Load Current, mA	1.2	1.8	2.5
Saturation Voltage, V	0.08	0.12	0.15
Clamping Voltage, V	60	-	73
Pull-up Resistor, Kohms		14k7	
Analog Input Voltage, V	0		16

Table 4: TABS6 Auxiliary Electrical Characteristics

[1] Note: AUX1 and AUX2 must also be configured as inputs if AUX5 is configured as input.

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3.1.10 Power-Up Sequence (functions)

At power-up, the TABS6 will performs a series of system self-checks. By observing the events, a driver or technician can determine the status of the ABS system. The power-up sequence occurs when initial brake light or ignition power is applied.

3.1.10.1 ABS Warning Lamp (trailer mounted)

At power-up, the trailer ABS warning lamp will turn on for 2.25 seconds and then go out to indicate that the system is functional with no faults. Failure of the lamp to illuminate during power up is an indication of a failure of the ABS warning lamp circuit, or the presence of wheel speeds.

3.1.10.2 Trailer ABS Warning Lamp (dash mounted)

At vehicle power-up, if PLC signals are received from a trailer, the dash mounted trailer ABS warning lamp will illuminate for 2.25 seconds. If the TABS6 is not faulted, the lamp will then turn off. If the TABS6 is faulted, the dash-mounted trailer ABS warning lamp will remain illuminated. The dash mounted trailer ABS warning lamp will not perform a power-up bulb check unless a PLC signal is received from a trailer ABS unit or diagnostic tool.

3.1.11 Auto-Configuration (Premium TABS6 only)

If the TABS6 detects additional sensors and modulators at a power-up, the TABS6 will perform an auto-configuration. TABS6 only auto-configures upward (e.g. 2S/2M Side to a 4S/2M Side configuration) as shown in Table 5.

Additional detected components that do not conform to a legitimate configuration will generate the appropriate faults. If wheel speeds are detected before TABS6 has accepted the new configuration, the reconfiguration cannot take place.

Bendix Offering	Default Configuration	Additional Components		Auto-Configuration
		Sensors	Modulators	
Option #1	2S/1M – Dolly Axle	-	-	2S/1M (Dolly-Axle)
		-	1	➥ 2S/2M (Side)
		2	1	➥ 4S/2M (Side)
		2	2	➥ 4S/3M (Side/Axle)
Option #2	2S/1M – Axle	-	-	2S/1M (Axle)
		-	1	➥ 2S/2M (Axle)
		2	1	➥ 4S/2M (Axle)

Table 5: TABS6 Premium Auto-Configuration Matrix

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3.1.12 Auxiliary Design Language (ADL)

The TABS6 Auxiliary Design Language (ADL) features allows customized auxiliary functions to be developed and downloaded at the production line or in the field, to control non-braking functions of the trailer. ADL reads/controls the TABS6 auxiliary I/O's and/or the SAE J1587 diagnostics and SAE J2497 PLC data links. Refer to Section 3.1.9 for available auxiliary ECU pins and capabilities. Figure 5 presents some potential trailer applications that can be achieved with ADL.

Contact the BCVS local representative to discuss an ADL application and method to implement into TABS6.

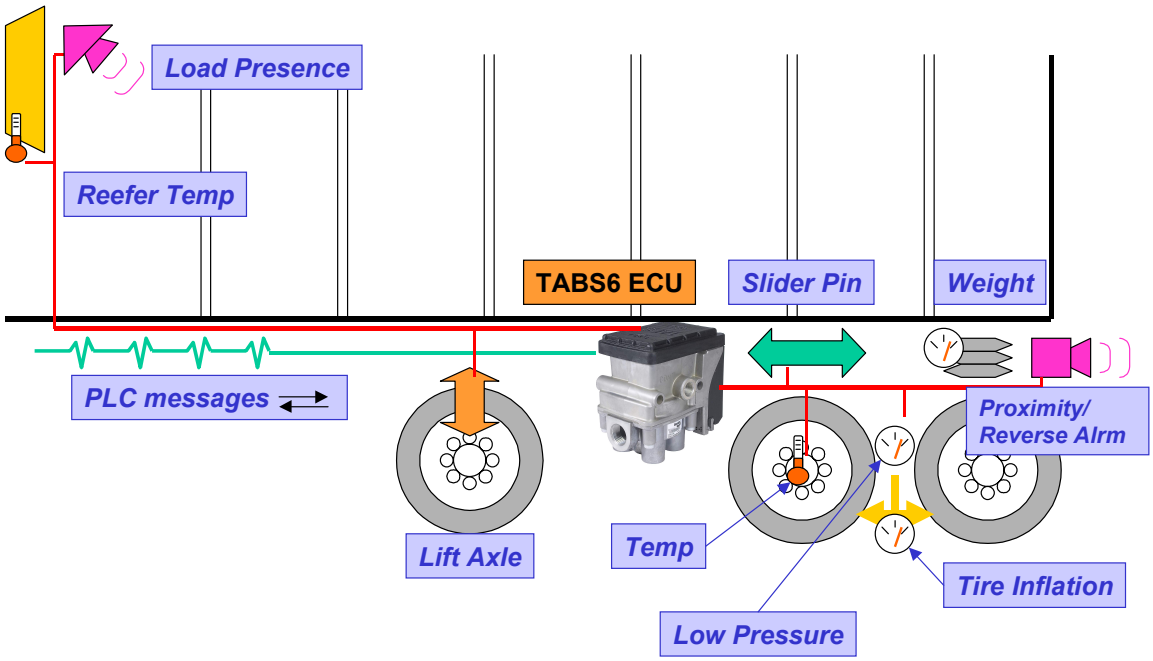

Figure 5: Example Trailer Applications via Auxiliary Design Language (ADL)

3.1.13 Customer Scratch Pad

The TABS6 includes Customer Scratch Pad feature in the EEPROM to provide up to 756 bytes total of data, freely definable by the customer or end-user. The scratch pad feature can be accessed using the *Bendix® ACOM™* Diagnostic Software (version 3.0 or higher) as described in Section 5.5.3.

If additional scratch pad space is needed, a configuration bit can be set to include additional area of 252 bytes of data (1,008 bytes total of data). Contact BCVS for details.

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3.1.14 Odometer Functions

3.1.14.1 Odometer

The TABS6 includes an Odometer function to provide a means of storing the accumulated mileage of the vehicle. The mileage is computed by utilizing information calculated from the vehicle wheel speeds. This feature has a resolution of 0.62 miles (1.0-Km) per power-up and will store the mileage up to 10,000,000 miles (16,700,000 Km). The mileage can be displayed using the PC-diagnostics or through blink codes.

When the TABS6 is power supplied only with the brake lamp power (towed with pre-1997 tractors), the electronic odometer does not function, and the mileage can be considered out-of-calibration.

3.1.14.2 Trip Counter

The TABS6 provides a counter to record the trip mileage. The feature is accessed through PC or hand-held tools diagnostic tools.

3.1.14.3 Service Interval

The TABS6 provides a feature to indicate a service interval for the trailer. The service interval can be assessed via PC or hand-held tools diagnostic tools. If configured, the TABS6 can flash the warning light with the vehicle at standstill to indicate when the service interval has been exceeded.

3.1.15 System Schematic Diagrams

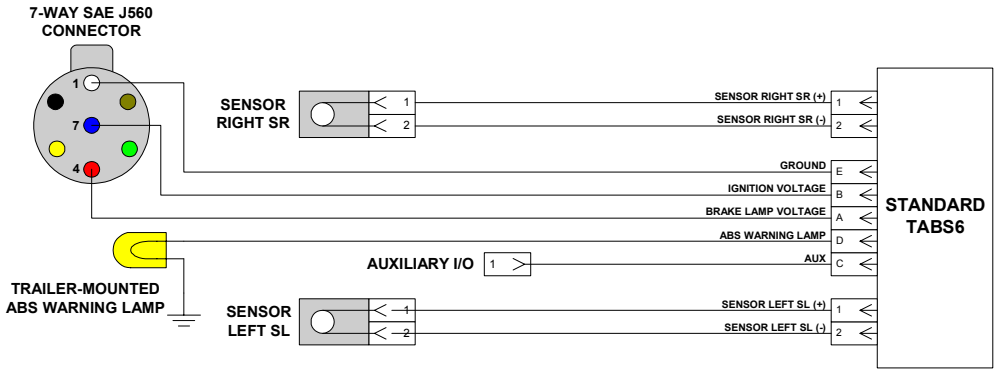

Figure 6: Schematic Diagram Standard TABS6 2S/1M

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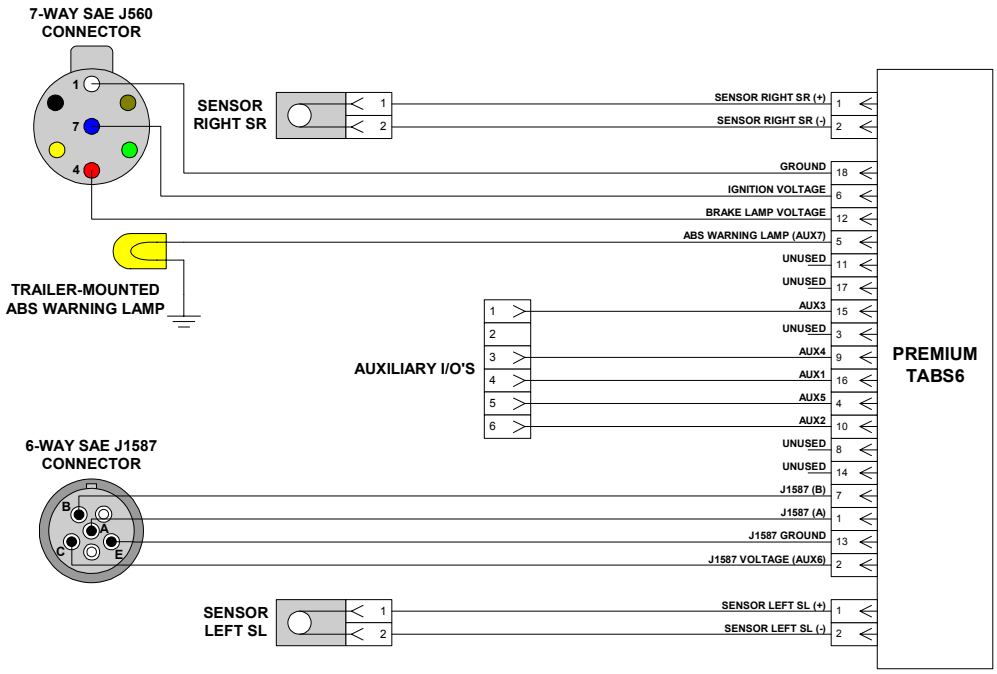

Figure 7: Schematic Diagram Premium TABS6 2S/1M

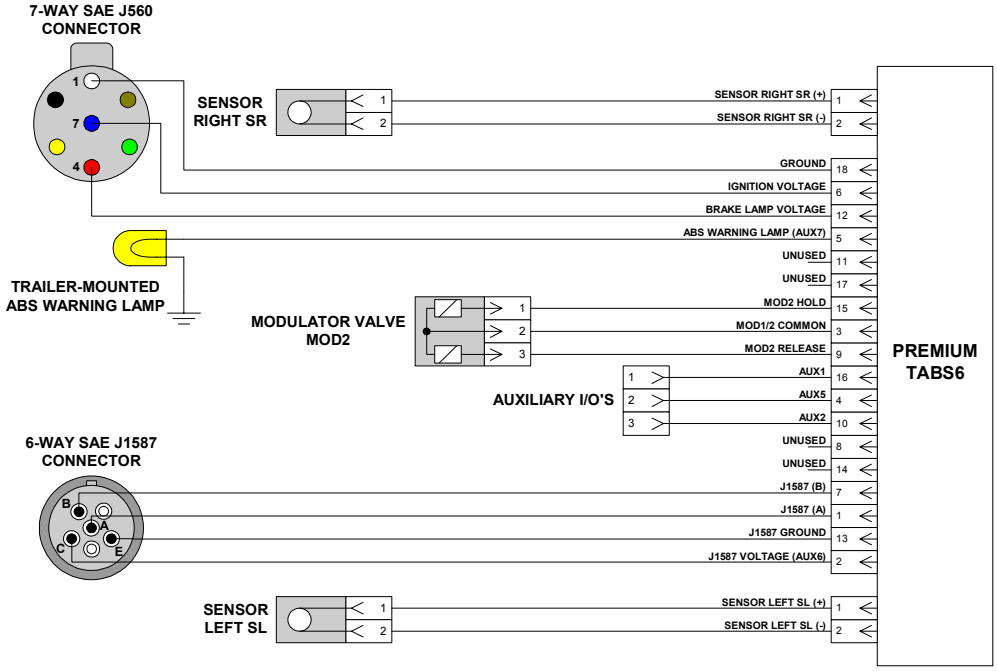

Figure 8: Schematic Diagram Premium TABS6 2S/2M

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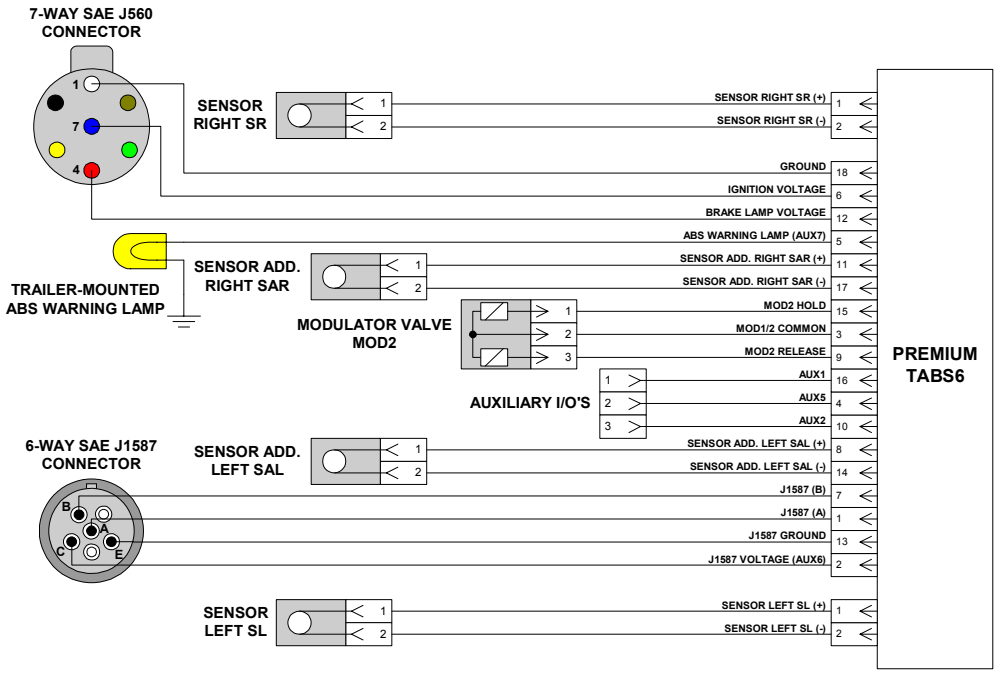

Figure 9: Schematic Diagram Premium TABS6 4S/2M

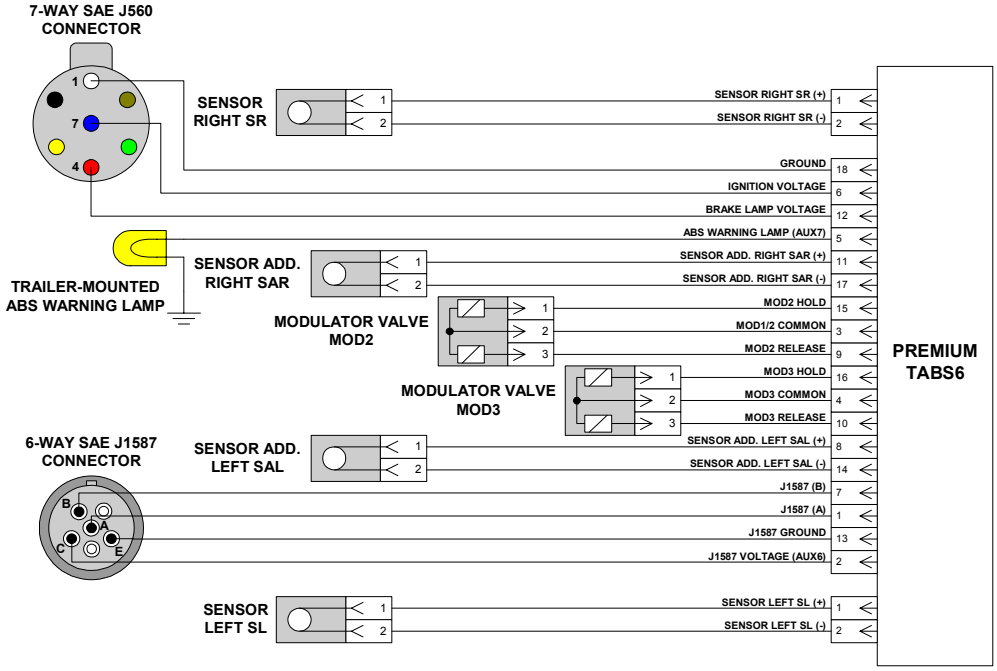

Figure 10: Schematic Diagram Premium TABS6 4S/3M

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3.2 TABS6 Trailer ABS Wire Harnesses

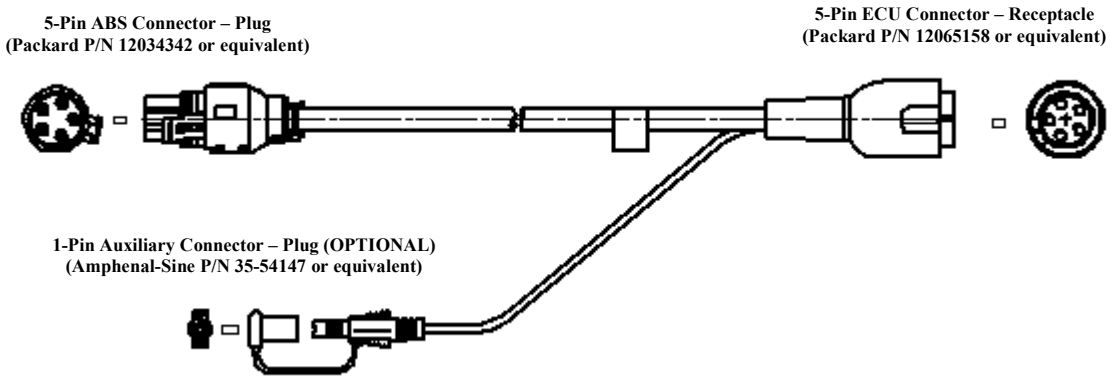
5-Pin ABS Connector – Plug
(Packard P/N 12034342 or equivalent)
5-Pin ECU Connector – Receptacle
(Packard P/N 12065158 or equivalent)
1-Pin Auxiliary Connector – Plug (OPTIONAL)
(Amphenal-Sine P/N 35-54147 or equivalent)

Figure 11: TABS6 Wire Harness – Standard Harness (Ref. Drw. 5015013)

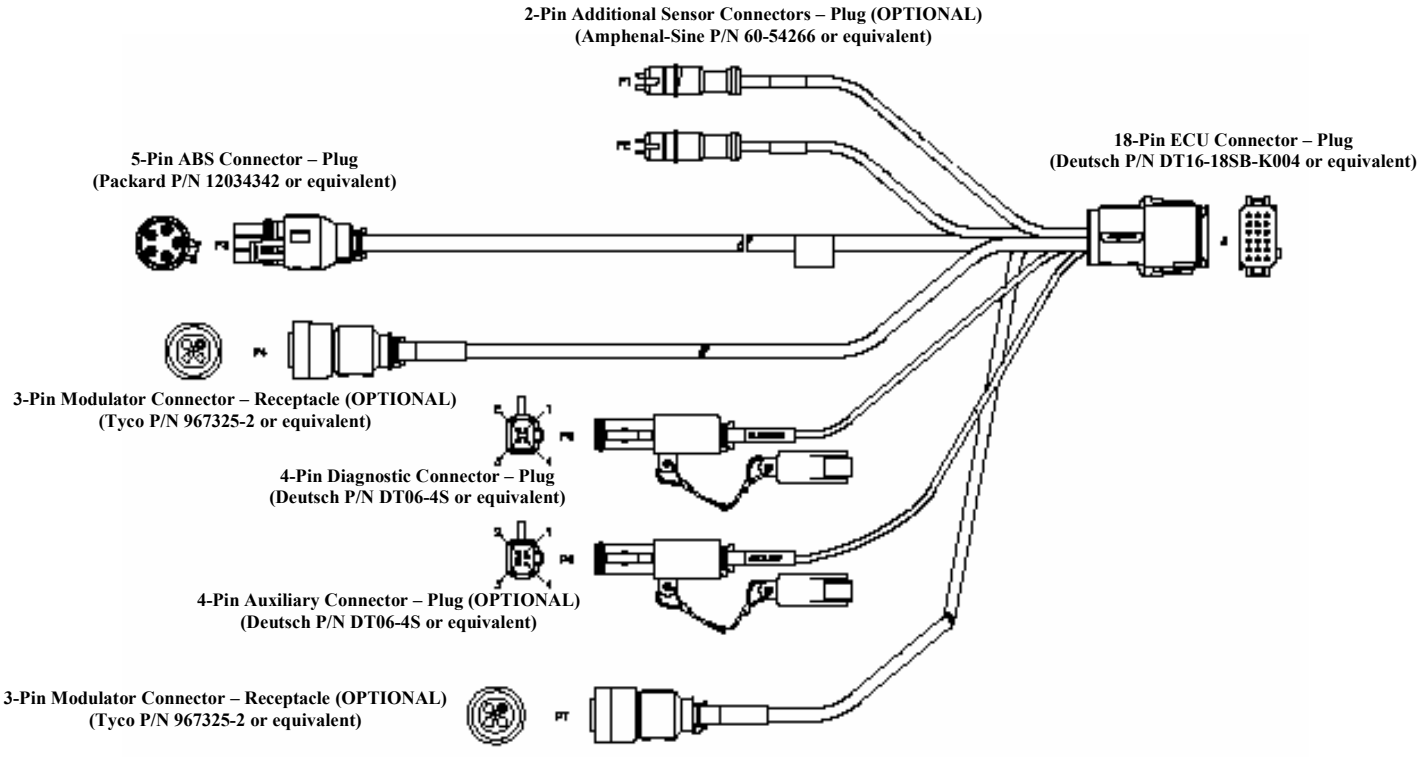
2-Pin Additional Sensor Connectors – Plug (OPTIONAL)
(Amphenal-Sine P/N 60-54266 or equivalent)
5-Pin ABS Connector – Plug
(Packard P/N 12034342 or equivalent)
18-Pin ECU Connector – Plug
(Deutsch P/N DT16-18SB-K004 or equivalent)
3-Pin Modulator Connector – Receptacle (OPTIONAL)
(Tyco P/N 967325-2 or equivalent)
4-Pin Diagnostic Connector – Plug
(Deutsch P/N DT06-4S or equivalent)
4-Pin Auxiliary Connector – Plug (OPTIONAL)
(Deutsch P/N DT06-4S or equivalent)
3-Pin Modulator Connector – Receptacle (OPTIONAL)
(Tyco P/N 967325-2 or equivalent)

Figure 12: TABS6 Wire Harness – Premium Harness (Ref. Drw. 5015018)

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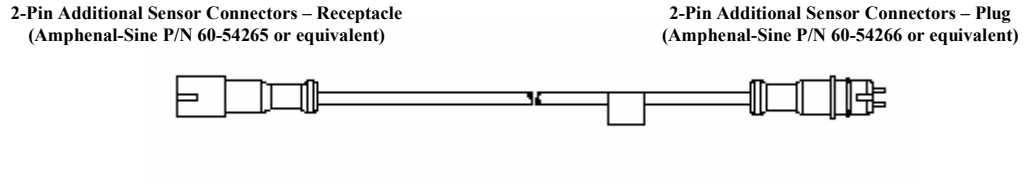
2-Pin Additional Sensor Connectors – Receptacle
(Amphenal-Sine P/N 60-54265 or equivalent)
2-Pin Additional Sensor Connectors – Plug
(Amphenal-Sine P/N 60-54266 or equivalent)

Figure 13: TABS6 Wire Harness – Wheel Speed Extension Cable (Ref. Drw. 6000365)

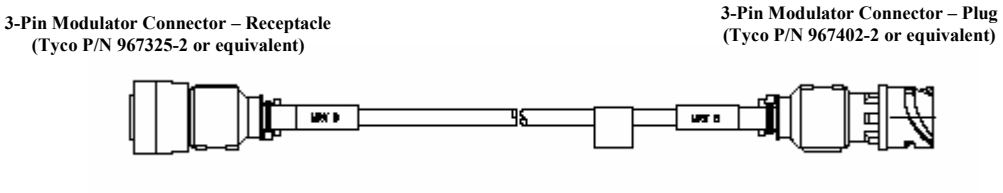
3-Pin Modulator Connector – Receptacle
(Tyco P/N 967325-2 or equivalent)
3-Pin Modulator Connector – Plug
(Tyco P/N 967402-2 or equivalent)

Figure 14: TABS6 Wire Harness – Remote Modulator Extension Cable (Ref. Drw. 5013343)

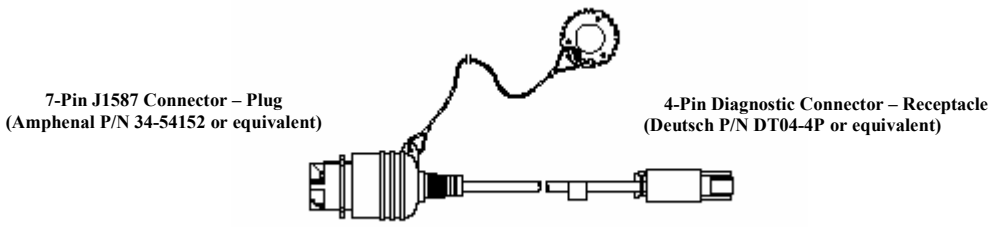
7-Pin J1587 Connector – Plug
(Amphenal P/N 34-54152 or equivalent)
4-Pin Diagnostic Connector – Receptacle
(Deutsch P/N DT04-4P or equivalent)

Figure 15: TABS6 Wire Harness – Diagnostic Extension Cable (Ref. Drw. 5007833)

3.3 WS-24 Wheel Speed Sensor (WSS)

The WS-24 Wheel Speed Sensor (WSS) consists of a coil, pole piece and permanent magnet, packaged in molded plastic and a stainless steel sheath. It works with an exciter ring (also referred to as a tone wheel) that is typically pressed on to the hub to provide wheel speed information to the TABS6 ECU. See BW-260-PR for details regarding the wheel speed sensor.

The WS-24 WSS is available in both straight and right angle (or 90º) models, in a variety of lengths with various wire harness connectors.

The WS-24 WSS is typically installed in mounting blocks welded to the axle housing. The sensor must be installed with a *Bendix*® beryllium copper clamping sleeve (*Bendix*® part number 5012878). The clamping sleeve provides a friction fit between the mounting block bore and the WS-24. The friction fit allows the sensor to slide back and forth under force but retain its position when the force is removed. See BW-269-PR for details regarding the clamping sleeve.

When the WS-24 WSS is inserted completely into the mounting block and the wheel is installed on the axle, the exciter ring contacts the sensor, causing the sensor to be

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pushed back slightly. Normal bearing endplay will also cause the sensor to be pushed slightly away from the exciter ring. These two actions establish an air gap between the sensor and exciter ring.

The exciter ring is provided by the hub supplier, which contains equally spaced high/low areas called “teeth”. Exciter rings typically contain 100 teeth.

The WS-24 WSS magnet and pole piece develop a magnetic field. When the wheel rotates, the exciter ring teeth pass through the magnetic field. This alters the magnetic field and generates an AC voltage in the sensor coil. The frequency of this AC signal is analyzed by the TABS6 ECU to determine the speed of the wheel. As the speed of the wheel increases, so does the frequency of the AC signal.

The voltage amplitude of the AC signal is an indication of the air gap between the WS-24 WSS and the exciter ring. The signal amplitude will increase as the air gap decreases.

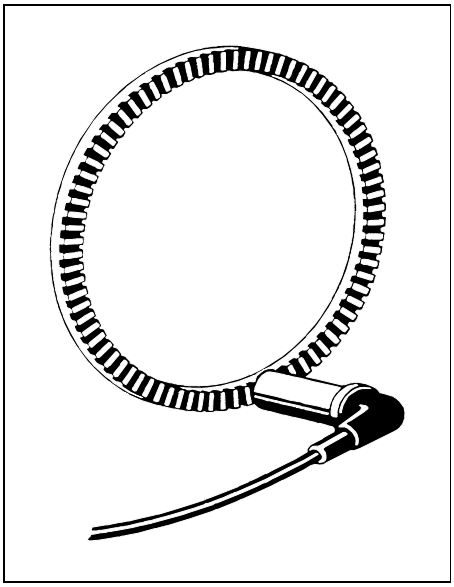

Figure 16: Wheel Speed Sensor with Tone Wheel

3.3.1 WS-24 WSS Specifications

Parameter	Limits
Nominal Resistance	1750 Ω ± 175 Ω @ room temperature
Inductance	1.3H ± @ 1kHz/1VRMS
Output Voltage	0.400 VAC @ a minimum of 100 Hz (~ 7 MPH)

Table 6: WS-24 WSS Specifications

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3.4 BR9235 Modulator Relay Valve (MRV)

The BR9235 Modulator Relay Valve (MRV) is required when additional MRV's are needed for multi-channel TABS brake systems (e.g. 2S/2M, 4S/3M ABS configurations). The BR9235 MRV is controlled by the TABS6 ECU to modify driver applied air pressure to the service brakes during ABS activation. The ABS modulator-valve is an electro-pneumatic control valve and is the last valve that air passes through on the way to the brake chambers. The normally open hold solenoid and normally closed exhaust solenoid are activated to precisely modify the brake pressure on command.

During normal braking, the BR9235 MRV functions as a standard relay valve. As brakes are applied or released by the driver, the control signal from the tractor foot valve causes the BR9235 MRV to apply proportional pressure to the trailer brake chambers.

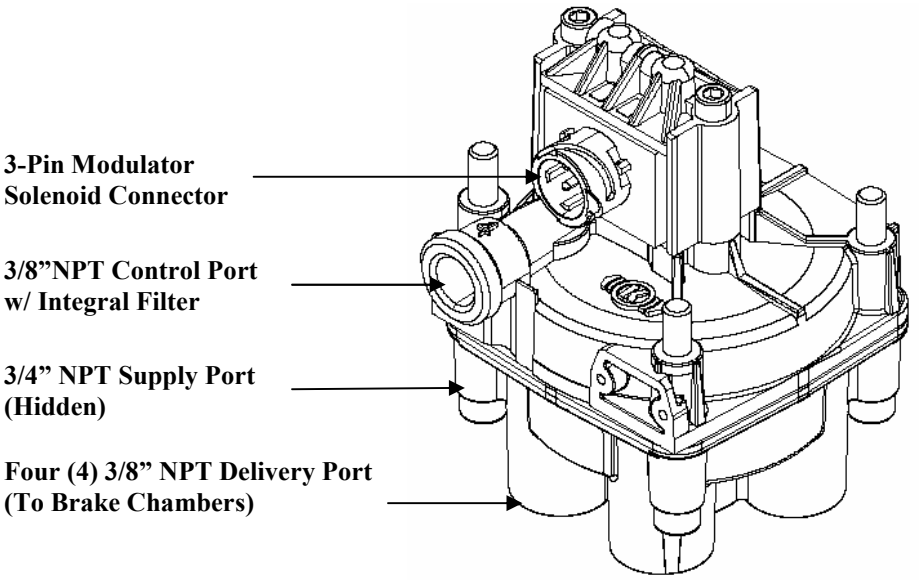
3-Pin Modulator Solenoid Connector
3/8"NPT Control Port w/ Integral Filter
3/4" NPT Supply Port (Hidden)
Four (4) 3/8" NPT Delivery Port (To Brake Chambers)

Figure 17: BR9235 Modulator Relay Valve (MRV)

3.4.1 BR9235 MRV Specifications

3.4.1.1 Solenoid Characteristics

The relay valve solenoids meet the following characteristics (at 75 °F / 25 °C):

	Min	Typ	Max	Value
Voltage range	6.8	12	15.7	V
Resistance	5.0	5.5	7.5	Ohm

Table 7: BR9235 MRV Solenoid Characteristics

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3.4.1.2 Crack Pressure

The BR9235 MRV is available with nominal crack pressure of 3.0 ± 1.0 psi.

3.4.1.3 Control Line Filter

The BR9235 MRV has an integral nylon filter to prevent foreign material larger than 0.013 inches from entering the control port of the modulator relay valve. This filter body is made of nylon and is screwed in place directly in the control line port. The filter is serviceable with a screw-in replacement.

3.4.1.4 Timing

The BR9235 MRV is designed to meet FMVSS121 timing requirements when installed per Bendix recommended installation guidelines and/or Bendix system drawings. FMVSS121 timing compliance is the responsibility of the towed vehicle manufacturer.

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4 TABS6 Operating Conditions

4.1 Electrical

All test methods are according to SAE J1455 unless otherwise noted. Within all tests, a nominal voltage of 14.2 Volts is applied at a nominal temperature of 75 °F (25 °C) unless otherwise noted.

4.1.1 Power Requirements

For normal system function, the TABS6 operates within the 8.0 to 16 VDC voltage range.

Function Mode	Value
Operating Range	8.0 to 16.0 VDC
ECU Active	135 mA @ 12 VDC
ABS Active (1 modulator)	3.7 A @ 12 VDC
ABS Active (2 modulators)	5.2 A @ 12 VDC

4.1.2 Steady State Operation

The TABS6 withstands the following static voltages without any damage:

Voltage	System status	Remarks
-12.0 to 0 VDC	No system function, no damage	Reverse polarity
0 to 7 VDC	No system function	
7 to 8 VDC	No system function, Warning Light On, diagnosis running	Cold cranking
8 to 16 VDC	Normal system function	
16 to 28 VDC	No system function, no damage	Jumper start, regulator failure

4.1.3 ECU Housing Degree of Protection

With electrical connectors installed, the TABS6 ECU housing is designed to be dust tight and protected against water ingress according to DIN 40050 (part 9) IP 69K.

4.1.4 Load Dump

The TABS6 is designed to operate normally after transient “Load Dump” pulses (similar to SAE J1455 Section 4.11.2.2.1) are applied to the ECU. The pulses are applied to the ignition and battery input circuits only.

Parameter	Value	Unit
Applied Pulse	$14 + 86e^{(-t/0.4)} \pm 10$	V
Source Impedance	0.4 ± 0.1	Ohms
Total Pulses	5	Pulses
Time Between Pulses	1	min

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4.1.5 Inductive Switching

The TABS6 is designed to operate normally after transient "Inductive Load Switching" pulses (similar to SAE J1455 Section 4.11.2.2.2) are applied to the ECU.

Parameter	Value	Unit
Applied Pulse	$14 \pm 600e^{(-t/0.001)} \pm 5\%$	V
Source Impedance	≤ 20	Ohms
Total Pulses	10	Pulses
Time Between Pulses	≤ 20	sec

4.1.6 Mutual Coupling

The TABS6 is designed to operate normally after transient "Mutual Coupling" pulses (similar to SAE J1455 Section 4.11.2.2.3) are applied to the ECU.

Parameter	Value	Unit
Applied Pulse	$14 \pm 300e^{(-t/0.000015)} \pm 10\%$	V
Source Impedance	50 ± 5	Ohms
Total Pulses	10	Pulses
Time Between Pulses	≤ 20	sec

4.1.7 Power Line Noise

The TABS6 is designed to operate normally or indicate an abnormal voltage condition when the ECU is modulated with an AC signal as described below.

Parameter	Value	Unit
Amplitude	5 ± 0.5	Vp-p
Frequency	50 to 10,000	Hz
Signal Type	Sine	Wave
Application rate	200 ± 10	Hz/sec

4.1.8 Over-Voltage During Jump Start

When exposed to an over-voltage condition such as from jump starting, the TABS6 can sustain damage and need not function normally when the voltage is returned to normal. If damaged, the TABS6 will remain in a "fail-safe" condition with no shorts from supply power to ground, no valves activated, and or undetected faults.

Parameter	Value	Unit
Input Voltage	48 ± 0.5	VDC
Current Limit	30	Amps
Application Time	5	min

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4.1.9 Electrostatic Discharge

The TABS6 is designed to operate after being subjected to ESD testing similar to SAE J1113-13 Section 5 (Non-Powered Mode Test). The ECU shall operate normally after all pulses are applied.

Parameter	Value	Unit
Capacitor Source	150	pF
Output Resistance	2000	ohm

Test Sequence	Discharge Type	Test Voltage Level	Unit	Number of Discharges
1	Contact	±4	kV	3
2	Contact	±6	kV	3
3	Air	±8	kV	3
4	Contact	±8	kV	3
5	Air	±15	kV	3

4.1.10 Electromagnetic Compatibility

The TABS6 system (which includes ECU, MRV's, wheel speed sensors, and wiring) is subjected to EMI field testing from 10 kHz to 18 GHz.

Parameter	Value	Unit
Minimum Frequency	10	KHz
Maximum Frequency	18	GHz
Test Level	150	V/m
Modulation (Sine Wave AM)	1 @ 80%	KHz

4.2 Temperature

All test methods are according to SAE J1455 unless otherwise noted.

4.2.1 Operating Range

The TABS6 is operational in ambient air temperatures ranging from -40°F to +185°F (-40°C to +85°C).

4.2.2 Storage Range

The TABS6 is capable of withstanding an ambient temperature range from -40°F to 230°F (-40°C to +110°C) without operation.

4.2.3 Thermal Cycle

The TABS6 is capable of withstanding a minimum of twenty thermal cycles from -40°F to +185°F (-40°C to 85°C) with no degradation in performance.

4.2.4 Humidity

The TABS6 is capable of operating in conditions of 95 % relative humidity at +105°F (+40°C).

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4.3 Pressure

4.3.1 Maximum Operating Pressure

The TABS6 is operational with a maximum supply and control air pressure of 145-psi (10 bar).

4.3.2 Over-Pressurization

The TABS6 is capable of withstanding an over-pressurization of 600-psi (41 bar) without any external damage to the unit and need not function normally after returning to normal operating pressure conditions.

4.4 Mechanical

All test methods are according to SAE J-1455 unless otherwise noted. During all tests, a nominal voltage of 14.2 Volts is applied at a nominal temperature of 75°F (25°C) unless otherwise noted.

4.4.1 Random Vibration - Frame Mount

The frame-mounted TABS6 is designed of operate normally after each principal plane is subjected to five (5) hours of random vibration at the following break points:

Frequency (Hz)	Vertical Axis	Both Horizontal Axis
	Amplitude (g^2/Hz)	Amplitude (g^2/Hz)
6	0.050	0.030
42	0.200	0.125
78	0.200	0.125
102	0.075	0.037
198	0.075	0.037
282	0.350	0.175
378	0.250	0.130
500	0.004	0.003
1000	0.001	0.005
Approximate GRMS	**8.6 GRMS**	**6.4 GRMS**

4.4.2 Random Vibration - Tank Mount

The tank-mounted TABS6 is designed of operate normally after the vertical plane is subjected to twenty (20) hours of random vibration at the following break points:

Frequency (Hz)	Vertical Axis
	Amplitude (g^2/Hz)
6	0.001
100	0.001
150	0.150
250	0.001
500	0.001
Approximate GRMS	**2.1 GRMS**

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4.4.3 Mechanical Shock

The TABS6 is designed of operate normally after each principal plane is subjected to three (3) half-sine shocks:

Parameter	Value	Unit
Acceleration	70	g
Duration	6	msec

4.4.4 Drop Test

The TABS6 is designed to function normally with no obvious damage when dropped three (3) times on each principal axis at a height of 40 inches (1 m) on a level concrete floor.

If there is obvious damage that would result in part rejection (cracked enclosure, damage to the connector or terminals), the TABS6 is not required to function.

4.5 Climate

4.5.1 Combined Environment "AGREE"

The TABS6 is designed to function normally after being subjected to a combined environment test consisting of temperature cycling, humidity, and 3.47 GRMS vibration (applied during all temperature transitions). The total test time is equal to one product life. ABS and ignition cycles are performed throughout the test.

Parameter	Value	Unit
Maximum Temperature	+85 ± 5	°C
Minimum Temperature	-40 ± 5	°C
Humidity[2]	95	%

4.5.2 Chemical Exposure

The TABS6 is designed to be capable of withstanding splash exposure to the following chemicals. After the chemicals have been applied and left on for twenty-four (24) hours, the TABS6 will be dried. The TABS6 shall operate normally after all exposures.

- Acetone
- Antifreeze
- ASTM #3 Oil
- Battery Acid
- CI-4 Engine Oil
- Diesel Fuel
- Methyl Alcohol
- Ammonia
- ASTM #1 Oil
- ASTM Type A Fuel
- Brake Fluid
- Detergent
- Gasoline
- Paint Stripper

[2] Humidity is applied five (5) out of six (6) cycles @ maximum temperature. It is reduced to 5% on the sixth cycle.

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4.5.3 High Pressure Wash

The TABS6 is designed to function normally after being subjected to a high-pressure wash to the following parameters:

Parameter	Value	Unit
Soapy Water Temperature	40 ± 5	°C
Soapy Water Pressure	1020	psi
Distance from TABS6	8-12	in
Flow rate	150	gal/hr
Cycle Time	3 sec (of a 6 sec cycle)	
Number of Cycles	375	

4.5.4 Salt Fog

The TABS6 is designed to function normally after being subjected to salt fog. At the completion of the salt fog profile, any corrosion must be less than two-thirds (2/3) of the TABS6 surface.

Parameter	Value	Unit
Temperature	35 ± 5	°C
Relative Humidity	95 ± 5	%
Salt Fog Solution	5 ± 2	%
Test Time	240	hr

4.5.5 Gravel Bombardment

The TABS6 is designed to function normally after subjected to gravel bombardment for a total time of two (2) minutes in accordance with SAE J400. De-graded performance is allowed only if attributed to visual damage, such as a damaged connector.

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5 TABS6 Diagnostics

5.1 Fault Detection

The TABS6 contains self-testing diagnostic circuitry that continuously checks for proper operation of internal components and circuitry, as well as external ABS components and wiring.

5.1.1 Active Faults

The TABS6 performs the following steps when an erroneous system condition is detected:

1. Illuminates the appropriate warning lamp(s) and disengages a portion or all of the ABS functions.
2. Places the appropriate fault code information in the ECU memory.
3. Broadcasts the appropriate fault code information over the diagnostic data bus as required.

All faults, with the exception of voltage, will remain in an active state for the remainder of the power cycle. Voltage faults will clear automatically when the voltage returns within the required limits. All ABS functions will be re-engaged.

The TABS6 provides a record of eight (8) active faults. Each record consists of the following data:

- Fault Number
- Occurrence Count, limited to a maximum of 255 counts
- Odometer Reading at last detection

When a new fault is to be stored and there are already eight (8) active faults recorded, the fault manager will overwrite the current active fault with the lowest odometer reading. The fault manager will attempt to move the overwritten fault to the event history.

Active faults remain in the fault memory until cleared using the diagnostic blink codes or an off-board diagnostic tool such as the *Bendix® ACOM™* diagnostic software.

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5.1.2 Event History Log

The TABS6 retains a record of all faults and comments (such as configuration changes) in non-volatile memory. This record is commonly referred to as Event History. When a fault self-heals or is manually cleared, the fault code remains in event history as an inactive fault.

The event history log consists of thirty (30) records. Each record shall consist of the following data:

- Type (fault, event, etc.)
- Whether active or inactive
- Odometer reading
- Fault number, event number, etc.

The event history log in the fault memory may be cleared using the diagnostic blink codes or an off-board diagnostic tool such as the *Bendix® ACOM™* diagnostic software.

5.2 System Faults

5.2.1 ECU Faults

The TABS6 continuously monitors the ECU for correct operation. If a problem with the normal operation is detected, all control functions is turned off as long as this fault is active. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.2 Power Supply Diagnostics

5.2.2.1 Low Voltage

The TABS6 detects if supply voltage is below 8V. All control functions are turned off as long as this fault is active. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.2.2 Low Voltage during Chuff Test (voltage supply, high resistance)

The TABS6 detects during the Chuff Test at power-up if a significant voltage drop exist. All control functions are turned off as long as this fault is active. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.2.3 High Voltage

The TABS6 detects if supply voltage is greater than 16V. All control functions are turned off as long as this fault is active, and the low side switch shall be switched off to prevent damage to the valve driver circuitry. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

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5.2.3 Wheel Speed Sensing

The error detection of this component can be of two different types static or dynamic detection. Errors that cannot be detected statically are detected through evaluation of the pattern of the wheel speed(s) (dynamically); the vehicle must drive with a minimum speed, which depends on the detection method.

5.2.3.1 Static Wheel Speed Sensor Fault Detection

The TABS6 detects if there are any permanent or intermittent electrical integrity issues affecting the wheel speed sensor circuits. The TABS6 decides if the issue may cause any degradation of the ABS performance. If so, then TABS6 will either select a partial operating mode or switch off all control functions. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.3.2 Dynamic Wheel Speed Signal Characteristic Fault Detection

5.2.3.2.1 Large Air-gap or Wheel Drag (Frozen Brake)

The TABS6 detects if any wheel is failing to register any wheel speed if the other wheels have been moving greater than 9.3 MPH (15km/h) for 15 seconds. This fault can only be detected on wheels that are not configured as lift axles. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.3.2.2 Tire Size Deviation

The TABS6 monitors if the wheel diameter differences of the wheel ends are within the ± 8% range. If a difference is within this range, the wheel speed calculation is adapted automatically, and the learned values are stored and reloaded after the next power-on cycle. If a difference is out of range, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.3.2.3 Sensor Signal Drop out

The TABS6 detects if any wheel has a sudden loss of wheel speed information for a specific amount of time, with or without an ABS event, as long as vehicle speed is present. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

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5.2.3.2.4 Defect (Missing) Tone Rings

The TABS6 monitors the wheel speed inputs and is capable of identifying and rejecting sporadic noise signals caused by missing tone rings.

5.2.3.2.5 All Speed Signals missing.

The TABS6 monitors the vehicle velocity data from PLC. If no trailer wheel speed information is being received, yet the vehicle velocity from PLC has been greater than 18.6 MPH (30km/h) for 120 seconds, a fault is recorded. This fault can only be detected on wheels that are not configured as lift axles. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.4 Modulator Diagnostics

5.2.4.1 Power-Up Chuff Test

With the TABS6 power applied at standstill, all the modulator solenoids are activated five (5) times in a rapid-fire fashion. This serves two (2) purposes; 1) it helps to prevent the solenoids from seizing and 2) it allows an audible indication that TABS6 is functioning.

5.2.4.2 Electrical Modulator Fault Detection

The TABS6 detects electrical errors in the modulators or associated wiring. The following faults are detected under all control modes:

- open circuit
- short circuit coil
- short circuit to ground
- short circuit to battery
- short circuit between solenoid's.

The TABS6 decides if the issue may cause any degradation of the ABS performance. If so, then TABS6 will either select a partial operating mode or switch off all control functions. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.4.3 Dynamic Modulator Fault Detection

The TABS6 monitors during an ABS event the expected wheel speed reaction at the wheel end. If the electrical circuit is known to be healthy, the TABS6 will disable the suspected modulator and either shall select either a partial operating mode or switch of all control functions. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

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5.2.4.4 ABS Long-term monitoring.

The TABS6 detects if there is any excessive ABS activation times and/or regular short ABS activation's over an extended period. All control functions are turned off as long as this fault is active. With this fault, the TABS6 illuminates the trailer-mounted warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

5.2.5 Auxiliary Output Diagnostics

The TABS6 detects electrical errors in the auxiliary outputs or associated wiring. The following faults are detected:

- open circuit
- short circuit coil
- short circuit to ground
- short circuit to battery
- short circuit between solenoid's.

The TABS6 shall illuminate the warning lamp and broadcast the diagnostic message over the diagnostic data bus if possible.

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5.3 Partial Failure ABS Modes

Detected faults shall have the affect of shutting down control to the entire ABS, or only to the affected channel. In some cases, TABS6 will attempt to compensate for detected faults without shutting down any functionality by utilizing data from other related portions of the system.

ABS Config.	Component – Fault								
	ECU	SAL	SAR	SL	SR	MOD1	MOD2	MOD3	Reaction
1S/1M – Axle & Dolly Axle	X								Full ABS Shut Down
				X					Full ABS Shut Down
					X				Full ABS Shut Down
				X	X				Full ABS Shut Down
						X			Full ABS Shut Down
2S/2M – Side & Axle	X								Full ABS Shut Down
				X					Full ABS Shut Down
					X				Full ABS Shut Down
				X	X				Full ABS Shut Down
						X			Full ABS Shut Down
							X		Side: Full ABS Shut Down Axle: Revert to 2S/1M[3]
						X	X		Full ABS Shut Down
4S/2M – Side & Axle	X								Full ABS Shut Down
				X					Full ABS Shut Down
					X				Full ABS Shut Down
				X	X				Full ABS Shut Down
						X			Full ABS Shut Down
		X							Side: Revert to 2S/2M – Side Axle: Revert to 2S/1M
			X						Side: Revert to 2S/2M – Side Axle: Revert to 2S/1M
		X	X						Side: Revert to 2S/2M – Side Axle: Revert to 2S/1M
							X		Side: Revert to 2S/1M[3] Axle: Revert to 2S/1M
						X	X		Full ABS Shut Down
4S/3M – Side, Axle	X								Full ABS Shut Down
				X					Full ABS Shut Down
					X				Full ABS Shut Down
				X	X				Full ABS Shut Down
						X			Full ABS Shut Down
		X							Revert to 2S2M – Side
			X						Revert to 2S2M – Side
		X	X						Revert to 2S2M – Side
							X		Revert to 4S/2M
								X	Revert to 2S2M – Side[3]
						X	X		Full ABS Shut Down

Table 8: TABS6 Partial Failure ABS Modes

[3] Full ABS shutdown if short-circuited to V_{bat}

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5.4 Blink Code Diagnostics

The TABS6 provides a means of retrieving and clearing diagnostic information, checking system configuration, displaying odometer mileage and performing limited system function checks by using blink code diagnostics. All fault and configuration information is displayed by flashing the trailer-mounted ABS warning lamp.

5.4.1 Blink Code Diagnostics - Activation

With ignition power applied, TABS6 monitors the number of brake lamp power-ups, to activate a blink code mode. Once the trail-mounted ABS warning lamp begins displaying codes, TABS6 will not respond to additional brake lamp inputs, until all blink code messages have been displayed and TABS6 has returned to normal operating mode.

In order to prevent unintentional activation of blink codes, if ignition power is continuously applied for greater than 15.0 seconds, without entering blink code mode, the counting of the brake lamp power-up in TABS6 is disabled.

Following a single display of all available messages, the trailer-mounted ABS warning lamp shall remain illuminated for 5.0 seconds and then return to normal operating mode. Multiple occurrences of a fault shall only be displayed once. If wheel or vehicle speed is detected at any time during blink code diagnostics, TABS6 returns to normal operating mode.

Action	Timing
Ignition “Power On”	Continuous
Max ignition “Power On” duration, before recognizing the brake light power	< 1.0 sec.
Max ignition “Power On” duration, without entering blink code mode, before brake light power cycle counter is disabled	15.0 sec.
Max constant brake light power duration before brake light power cycle counter is disabled	5.0 sec.
Brake light “Power On” cycle	1.0 sec. +/- 200ms
Brake light “Power Off” cycle	1.0 sec. +/- 200ms
Delay before blink code output begins following activation	5.0 sec.

Table 9: Brake Lamp Power Activation Timing - (Blink Codes)

5.4.2 Blink Code Diagnostics - Activation Modes

Cycles to Enter Desired Mode	Cycles
Active Fault Diagnostic Code Retrieval	3
Inactive Fault Diagnostic Code Retrieval	4
Clear Active Faults Codes	5
System Configuration Check	6
Odometer Mileage Display	7
Reset ECU configuration.	8

Table 10: Blink Code Diagnostics - Activation Modes

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5.4.3 Blink Code Diagnostics - Lamp Timing

Action	Timing
Duration of indicator blink pulse (lamp on)	0.4 sec.
Duration of indicator blink pulse (lamp off)	0.4 sec.
Strobe characteristics for display of zero digit (ON-OFF-ON-OFF)	.2 Hz for .4 sec. @ 50% duty cycle
Duration between blink code digits	1.0 sec.
Duration between blink code messages	2.5 sec.
Duration of indicator illumination at completion of messages with Blink Code Diagnostics exited	5.0 sec.

Table 11: Blink Code Diagnostics – Lamp Timing

5.4.4 Blink Code Diagnostics – Diagnostic Troubleshooting Code (DTC)

For retrieving fault codes, the TABS6 blink code diagnostics is activated by cycling the brake lamp input three (3) times for active faults or four (4) times for inactive faults.

With TABS6 powered and the blink code diagnostics activated for active or inactive fault diagnostic code retrieval, the fault flash code is displayed by the trailer-mounted ABS warning lamp as shown in the following table.

1st Digit	2nd Digit	Fault Description	Repair Information	J1587 (SID)	J1587 (FMI)
1	1	No faults	• TABS6 system fully operational – no faults detected	1	0
Wheel Speed Sensors (WSS)					
2	1	SL Sensor signal valid - large air gap	• Check the air gap between the sensor and pole wheel, pushing-in sensor(s) if needed. • Rotate wheel and verify a min. of 0.25 VAC sensor output @ ~ 0.5 RPS. • Verify condition of sensor head. • Verify condition and retention of clamping sleeve. • Verify proper mounting of exciter ring and condition of teeth. • Check wheel bearings for correct adjustment. • Verify sensor lead routing and clamping.	1	0
3	1	SR Sensor signal valid - large air gap		2	0
4	1	SAL Sensor signal valid - large air gap		3	0
5	1	SAR Sensor signal valid - large air gap		4	0
2	2	SL Sensor signal valid - loss of signal	• Check for corroded/damaged wiring or connectors between the ECU and the WSS. • Check the air gap between the sensor and pole wheel, pushing-in sensor(s) if needed. • Rotate wheel and verify a min. of 0.25 VAC sensor output @ ~ 0.5 RPS. • Verify condition of sensor head. • Verify condition and retention of clamping sleeve. • Verify proper mounting of exciter ring and condition of teeth. • Check wheel bearings for correct adjustment. • Verify sensor lead routing and clamping.	1	1
3	2	SR Sensor signal valid - loss of signal		2	1
4	2	SAL Sensor signal valid - loss of signal		3	1
5	2	SAR Sensor signal valid - loss of signal		4	1
2	3	SL Sensor signal valid – noisy		1	2
3	3	SR Sensor signal valid – noisy		2	2
4	3	SAL Sensor signal valid – noisy		3	2
5	3	SAR Sensor signal valid – noisy		4	2

Table 12: Blink Code – Fault Description & Repair Information

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PRODUCT SPECIFICATION - BW-283-PR

1st Digit	2nd Digit	Fault Description	Repair Information	J1587 (SID)	J1587 (FMI)
Wheel Speed Sensors (WSS)					
2	4	SL Sensor shorted or open	• Check for corroded/damaged wiring or connectors between the ECU and the WSS. • Verify no continuity between sensor leads and ground. • Verify no continuity between sensor leads and other sensors. • Verify 950 – 1950 ohms across sensor leads (with sensors @ room temperature). • Verify that a +12 volt is not measured at either sensor leads.	1	4 or 5
3	4	SR Sensor shorted or open		2	4 or 5
4	4	SAL Sensor shorted or open		3	4 or 5
5	4	SAR Sensor shorted or open		4	4 or 5
2	5	SL Tire diameter out of range	• Verify correct tire size as desired. • Verify proper tire inflation. • Verify correct number of exciter ring teeth. • Verify that the ECU has the proper tire size settings.	1	13
3	5	SR Tire diameter out of range		2	13
4	5	SAL Tire diameter out of range		3	13
5	5	SAR Tire diameter out of range		4	13
4	6	SAL Sensor configuration error	• Verify correct ABS configuration using blink codes or other diagnostic tools • If needed, reset to the default ABS configuration and power-up to initiate auto-configuration.	3	13
5	6	SAR Sensor configuration error		4	13
Power					
6	1	Over-voltage	• Check for damaged wiring. • Check for damaged or corroded connectors and connections. • Measure battery voltage under load. • Verify that ABS unit is powered by a 12-volt power supply source.	251	3
6	2	Low-voltage	• Check for damaged wiring. • Check for damaged or corroded connectors and connections. • Measure battery voltage under load.	251	4
6	3	Excessive power line resistance	• Measure ignition voltage under load. • Check for damaged wiring. • Check for damaged or corroded connectors and connections.	251	13

Table 12: Blink Code – Fault Description & Repair Information (Cont.)

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1st Digit	2nd Digit	Fault Description	Repair Information	J1587 (SID)	J1587 (FMI)
Modulator MOD (AUX1 through AUX5)					
7	1	MOD1 Hold solenoid shorted or open	• Clear faults. • If faults return, replace the TABS6 Module.	42	3, 4, 5 or 12
7	2	MOD1 Release solenoid shorted or open		48	3, 4, 5 or 12
8	1	MOD2 Hold solenoid (AUX3) shorted or open	• Check for corroded/damaged wiring or connectors between the ECU and MOD2/3 (AUX3/1) • At the 18-pin ECU harness connector: - If MOD2 or MOD3, verify: ▪ 3 – 8 ohms resistance across hold solenoid to common ▪ 6 – 16 ohms resistance across hold solenoid to release solenoid - If AUX3 or AUX1, verify: ▪ Continuity of the AUX wiring to auxiliary device ▪ No continuity from AUX wiring to any other ECU 18-Pin Connector pins • At the device harness connector, verify: - If MOD2 or MOD3, verify: ▪ No continuity from modulator leads to ground ▪ +12V is not measured at the modulator leads with power applied to TABS6 - If AUX3 or AUX1, verify: ▪ No continuity from AUX leads to ground. ▪ +12V is not measured at the AUX leads. • At the device connector, verify: - If MOD2 or MOD3, verify: ▪ 3 – 8 ohms resistance across hold solenoid to common (Pins 2 to 3) ▪ 6 – 16 ohms resistance across hold solenoid to release solenoid (Pins 1 to 3) - If AUX3 or AUX1, verify: ▪ Expected resistance for auxiliary device • Replace/repair MOD2/3 (AUX3/1) wiring or components as required. • After repairs or if no issues found, then clear faults. • If faults return, replace the TABS6 Module.	43	3, 4, 5 or 12
9	1	MOD3 Hold solenoid (AUX1) shorted or open		44	3, 4, 5 or 12

Table 12: Blink Code – Fault Description & Repair Information (Cont.)

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1st Digit	2nd Digit	Fault Description	Repair Information	J1587 (SID)	J1587 (FMI)
Modulator MOD (AUX1 through AUX5)					
8	2	MOD2 Release solenoid (AUX4) shorted or open	• Check for corroded/damaged wiring or connectors between the ECU and MOD2/3 (AUX4/2) • At the 18-pin ECU harness connector: - If MOD2 or MOD3, verify: ▪ 3 – 8 ohms resistance across release solenoid to common ▪ 6 – 16 ohms resistance across hold solenoid to release solenoid - If AUX4 or AUX2, verify: ▪ No continuity from AUX leads to ground. ▪ +12V is not measured at the AUX leads. • At the device harness connector: - If MOD2 or MOD3, verify: ▪ No continuity from modulator leads to ground ▪ +12V is not measured at the modulator leads with power applied to TABS6 - If AUX4 or AUX2, verify: ▪ Continuity of the AUX wiring to auxiliary device ▪ No continuity from AUX wiring to any other ECU 18-pin connector pins • At the device connector: - If MOD2 or MOD3, verify: ▪ 3 – 8 ohms resistance across release solenoid to common (Pins 2 to 1) ▪ 6 – 16 ohms resistance across hold solenoid to release solenoid (Pins 1 to 3) - If AUX4 or AUX2, verify: ▪ Expected resistance for auxiliary device • Replace/repair MOD2/3 (AUX4/2) wiring or components as required. • After repairs or if no issues found, then clear faults. • If faults return, replace the TABS6 Module.	49	3, 4, 5 or 12
9	2	MOD3 Release solenoid (AUX2) shorted or open		50	3, 4, 5 or 12
7	3	MOD1 ABS modulator dynamic error	• No wheel response to ABS command between the ECU and MOD1. • Verify proper MOD activation with brake pressure applied, at power-up (Chuff Test) and/or using diagnostic tool. • For MOD2 or MOD3, verify correct wiring (not reversed) between 18-pin ECU and MOD harness connectors • Possible slow brake release, check for: - Dragging brakes - Dry bearings - Faulty return springs - Parking brake system faults - Restricted brake air lines - Over adjusted slacks - Out of round drums - Damaged/ loose tone rings. • Repair/replace MOD2/3 wiring/valve, TABS6 module or any other brake component as required.	7	7
8	3	MOD2 ABS modulator dynamic error		8	7
9	3	MOD3 ABS modulator dynamic error		9	7
8	4	MOD2 Valve configuration error	• Verify correct ABS configuration using blink codes or other diagnostic tools • If needed, reset to the default ABS configuration and power-up to initiate auto-configuration.	8	13
9	4	MOD3 Valve configuration error		9	13

Table 12: Blink Code – Fault Description & Repair Information (Cont.)

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1st Digit	2nd Digit	Fault Description	Repair Information	J1587 (SID)	J1587 (FMI)
Common					
10	1	Valve MOD1/2 low-side switch shorted to ground	• Check for corroded/damaged wiring or connectors between the ECU and MOD (AUX). • At the MOD (AUX) harness connector, verify: • No continuity from modulator/AUX leads to ground • After repairs or if no issues found, then clear faults. • If faults return, replace the TABS6 Module.	7	4
10	2	Valve MOD3 (AUX5) low-side switch shorted to ground		9	4
10	3	ABS modulator dynamic error - all valves	• No wheel response to ABS command between the ECU and MOD1. • Verify proper MOD activation with brake pressure applied, at power-up (Chuff Test) and/or using diagnostic tool. • For MOD2 or MOD3, verify correct wiring (not reversed) between 18-pin ECU and MOD harness connectors • Possible slow brake release, check for: - Dragging brakes - Dry bearings - Faulty return springs - Parking brake system faults - Restricted brake air lines - Over adjusted slacks - Out of round drums - Damaged/ loose tone rings. • Repair/replace MOD2/3 wiring/valve, TABS6 module or any other brake component as required.	7	7
10	4	Excessive ABS activity	• Check for corroded/damaged wiring or connectors between the ECU and the WSS. • Check the air gap between the sensor and pole wheel, pushing-in sensor(s) if needed. • Rotate wheel and verify a min. of 0.25 VAC sensor output @ ~ 0.5 RPS. • Verify condition of sensor head. • Verify condition and retention of clamping sleeve. • Verify proper mounting of exciter ring and condition of teeth. • Check wheel bearings for correct adjustment. • Verify sensor lead routing and clamping.	1	7
Electronic Control Unit (ECU)					
11	1	ECU internal error	• Check for damaged or corroded connectors. • Check for damaged wiring. • After repairs or if no issues found, then clear faults. • If faults return, replace the TABS6 Module.	254	12
11	2	ECU configuration error	• Verify correct ABS configuration using blink codes, PC-diagnostics or other off-board diagnostic tools • If needed, reset to the default ABS configuration and power-up to initiate auto-configuration.	254	13

Table 12: Blink Code – Fault Description & Repair Information (Cont.)

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1st Digit	2nd Digit	Fault Description	Repair Information	J1587 (SID)	J1587 (FMI)
Trailer-Mounted ABS Warning Lamp (AUX7)					
12	1	ABS lamp (AUX7) shorted or open	• Check for corroded/damaged wiring or connectors between the ECU and ABS Warning Lamp (AUX7) • Verify the following: - At the 5-pin or 18-pin ECU harness connector: ▪ Continuity of the ABS Warning Lamp (AUX7) wiring to the lamp (auxiliary device) ▪ +12V is not measured at ABS Warning Lamp (AUX7) lead - At ABS Warning Lamp (AUX7) connector: ▪ No continuity of the ABS Warning Lamp (AUX7) lead to ground ▪ No continuity from ABS Warning Lamp (AUX7) lead to any other ECU pin(s) • Replace/repair ABS Warning Lamp (AUX7) wiring or components as required	81	3, 4, 5 or 12
J1587 Diagnostic (AUX6)					
13	1	J1587 diagnostics (AUX6) shorted or open	• Check for corroded/damaged wiring or connectors between the ECU and J1587 Diagnostic (AUX6) • Verify the following: - At the 18-pin ECU harness connector: ▪ Continuity of the J1587 Diagnostic (AUX6) wiring to the lamp (auxiliary device) ▪ +12V is not measured at J1587 Diagnostic (AUX6) lead - At J1587 Diagnostic (AUX6) connector: ▪ No continuity of the J1587 Diagnostic (AUX6) lead to ground ▪ No continuity from J1587 Diagnostic (AUX6) lead to any other ECU pin(s) • Replace/repair J1587 Diagnostic (AUX6) wiring or components as required	250	3, 4, 5 or 12
Lining Wear Monitoring					
14	1	Brake pads worn – replace	• Manually check the condition of the pads on each brake to establish if any require replacement. • If no pads require replacement, check the wear sensors and cables for damage or defects. • After repairs or if no issues found, then clear faults. • If faults return, replace the TABS6 Module.	70	1

Table 12: Blink Code – Fault Description & Repair Information (Cont.)

5.4.5 Blink Code Diagnostics – Clear Active Faults Codes

To clear active faults, cycling the brake lamp input five (5) times activates the TABS6 blink code diagnostics.

With the TABS6 powered and the blink code diagnostics activated for clear active faults, the fault management clears the active faults in the fault memory. This method of resetting active faults does not clear the information stored in event history log, to prevent accidental data loss.

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5.4.6 Blink Code Diagnostics - System Configuration Check

To check the current ABS system configuration, cycling the brake lamp input six (6) times activates the TABS6 blink code diagnostics.

When the TABS6 is powered and the blink code diagnostics activated for system configuration check, the current ABS configuration flash code is displayed by the trailer-mounted ABS warning lamp as shown in the following table.

TABS6 Trailer ABS Configuration	
1st Digit	**Sensors**
2	2 Sensors
4	4 Sensors
2nd Digit	**Modulators**
1	1 Modulator
2	2 Modulators
3	3 Modulators
3rd Digit	**ABS Control Mode**
1	Axle
2	Side
3	Dolly-Axle
4	MOD1 Axle – MOD2 Axle Dolly-Axle
5	MOD1 Axle – MOD2 Axle Lift
6	Side(MOD1, MOD2) – MOD3 Dolly-Axle

Table 13: Blink Code – ABS Configurations

5.4.7 Blink Code Diagnostics - Odometer Mileage Display

For displaying the odometer mileage, the TABS6 blink code diagnostics is activated by cycling the brake lamp input seven (7) times. Odometer mileage cannot be altered by the use of the blink code diagnostics.

With the TABS6 powered and the blink code diagnostics activated for odometer mileage display, the current odometer distance flash code is displayed by the trailer-mounted ABS warning lamp in thousands of miles. As an example, 152,254 miles would be displayed by:

152 (x1000)… one (1) blink – pause, five (5) blinks – pause and two (2) blinks.

A zero (0) is displayed by quickly strobing the trailer-mounted ABS warning lamp twice.

5.4.8 Blink Code Diagnostics – Reset ECU Configuration

To reset the ECU configuration back to the default ABS configuration, cycling the brake lamp input eight (8) times activates the TABS6 blink code diagnostics.

With the TABS6 powered and the blink code diagnostics activated for reset ECU configuration, the “ABS configuration” is configured back to the base (default) ABS configuration as shown in the following table.

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Model	Bendix Offering	Current ABS Configuration	Base (Default) ABS Configuration
Standard	Option #1	2S/1M (Axle)	2S/1M (Axle)
	Option #2	2S/1M (Dolly-Axle)	2S/1M (Dolly-Axle)
Premium	Option #1	2S/1M (Dolly-Axle)	2S/1M (Dolly-Axle)
		2S/2M (Side)	
		4S/2M (Side)	
		4S/3M (Side/Axle)	
	Option #2	2S/1M (Axle)	2S/1M (Axle)
		2S/2M (Axle)	
		4S/2M (Axle)	

Table 14: Blink Code Diagnostics – ECU Reset Configurations

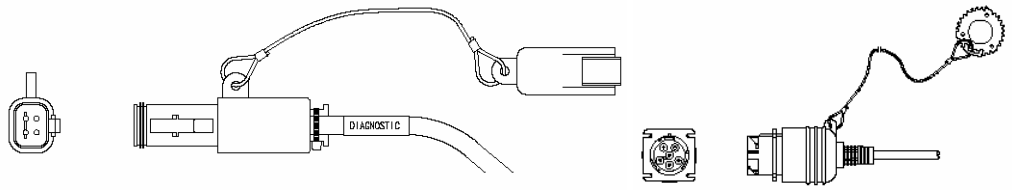
5.5 Off-Board Diagnostics

5.5.1 SAE J2497 PLC Diagnostics

For TABS6, the SAE J2497 data link also functions as a link to PC-based diagnostic systems and other off-board user interface devices. Full diagnostic, parameter setting and software download capability can be performed over the SAE J2497 data link, using SAE J1587 type messages.

5.5.2 SAE J1587 Diagnostic Connector

For the Premium TABS6, the diagnostic and data exchange via SAE J1587 with a PC or pro-link tester is possible by connecting the data line to diagnostic connector. TABS6 provides this interface with either the 4-pin Deutsch diagnostic DT06 connector as part of the TABS6 pigtail harness, or on the 6-pin Deutsch diagnostic HD10 connector if the trailer is equipped with the diagnostic extension cable. The pin assignment of the diagnostic connectors is shown below.



4-Pin Deutsch DT06 Series connector		6-Pin Deutsch HD10 Series connector	
Pin	Designation	Pin	Designation
1	SAE J1587 Power	A	SAE J1587 (+)
2	SAE J1587 Ground	B	SAE J1587 (–)
3	SAE J1587 (+)	C	SAE J1587 Power
4	SAE J1587 (–)	D	Not Used
		E	SAE J1587 Ground
		F	Not Used

Figure 18: ECU Identification & Pin-Out - Premium TABS6

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5.5.3 *Bendix*® *ACOM*™ Diagnostic Software

Bendix® *ACOM*™ Diagnostic Software (version 3.0 or higher) is an RP-1210A compliant PC-based diagnostic software program that provides the highest level of diagnostic support for the TABS6. With *Bendix*® *ACOM*™ Diagnostic Software, maintenance personnel can:

- Obtain fault information (both active and inactive faults)
- Retrieve event history
- Clear inactive faults and event history
- Verify ECU configuration
- Perform system and component tests
- Read/write customer information on scratch pads
- Save and print information
- Receive troubleshooting assistance

When diagnosing the TABS6 using a PC and *Bendix*® *ACOM*™ Diagnostic Software, the computer's serial or parallel port can be connected to the vehicle's diagnostic connector through a RP-1210A compliant communications device.

Contact BCVS to obtain the diagnostic software.

5.5.4 Pro-Link™ Support

A Pro-Link™ device will be available to support TABS6 diagnostics. Contact BCVS for details.

5.5.5 Trailer Remote Diagnostic Unit (TRDU)

The *Bendix*® Trailer Remote Diagnostic Unit (TRDU) is a handheld diagnostic tool that connects to the vehicle's diagnostic connector and provides diagnostic information using LED's. It is available in a variety of styles. See BW-284-PR for details.

The TRDU also contains a magnetic reset switch to permit clearing of active faults and a method to initiate a reconfiguration event.

The TRDU contains ten- (10) diagnostic LED's to display system status.

LED	LED Definition	LED Display	LED Color
VLT	Voltage	ECU Power	Green
ECU	Electronic Control Unit	Fault Type	Red
SEN	Wheel Speed Sensor	Fault Type	Red
MOD1	Modulator 1	Fault Type	Red
MOD2	Modulator 2	Fault Type	Red
MOD3	Modulator 3	Fault Type	Red
LFT	Left	Fault Location	Red
RHT	Right	Fault Location	Red
ADD	Additional Axle	Fault Location	Red
ODO	Odometer	Mileage	Blue

Table 15: TRDU – LED Description

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5.6 Technical Assistance

5.6.1 Technical Assistance (Internet)

The TABS6 Service Data manual is available for download at www.bendix.com. This manual contains descriptions, maintenance information, and troubleshooting hints to assist in the maintenance of the TABS6.

5.6.2 *Bendix*® Technical Assistance Team

For technical assistance, contact the *Bendix*® Technical Assistance Team at 1-800-AIR-BRAKE (1-800-247-2725) Monday through Friday, 8:00 a.m. to 6:00 p.m. EST.

The *Bendix*® Technical Assistance Team may also be reached via email at tbs.techteam@bendix.com.

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6 Installation

6.1 TABS6 Trailer ABS Assembly Mounting

The TABS6 Trailer ABS assembly can be installed either on the reservoir or on the frame rail. For both the reservoir mount or frame mount configurations, the exhaust port of the relay valve must face downwards.

6.1.1 Reservoir Mount Configuration

The TABS6 can be mounted using a ¾" heavy wall steel nipple, directly between the reservoir and the supply port.

6.1.1.1 Pipe Fitting Torque's

Refer to the following torque specifications when installing pipe nipples. Torque's are for NPT threads with thread sealant applied. Do not use thread tape. Contamination by thread tape can cause component failure. Tighten pipe nipples as follows:

- With Thread Sealant - Finger tight plus 1-1/2 turns
- Without Thread Sealant - Finger tight plus 2 turns

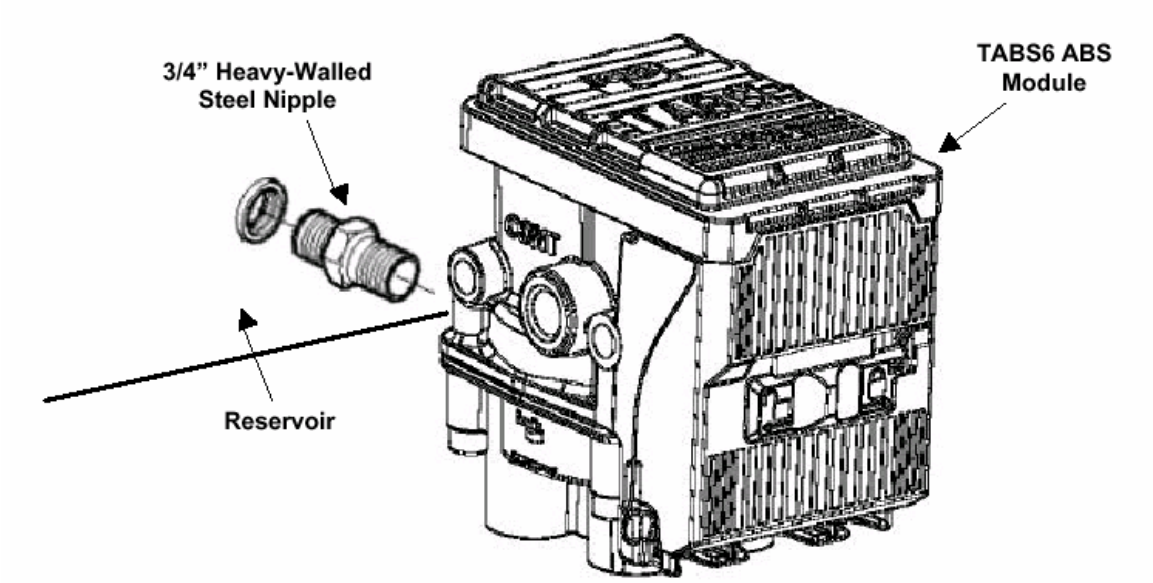

Figure 19: TABS6 Reservoir Mount

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6.1.2 Frame Mount Configuration

The TABS6 can be mounted to the frame rail or cross-member. Through-holes are provided for use of 3/8" fasteners. Bendix recommends the minimum use of Grade 5 bolts, nuts and washers. Typical minimum length required is 5 inches.

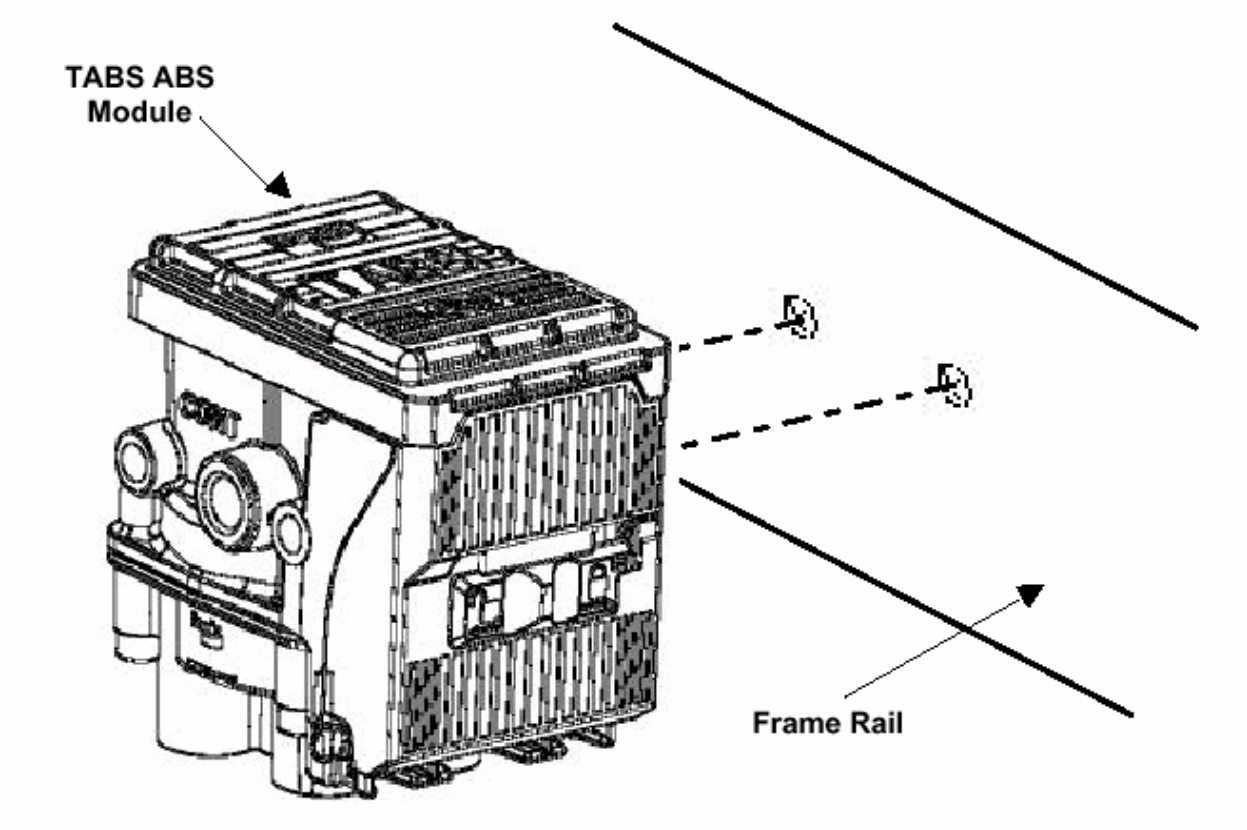

Figure 20: TABS6 Frame Mount

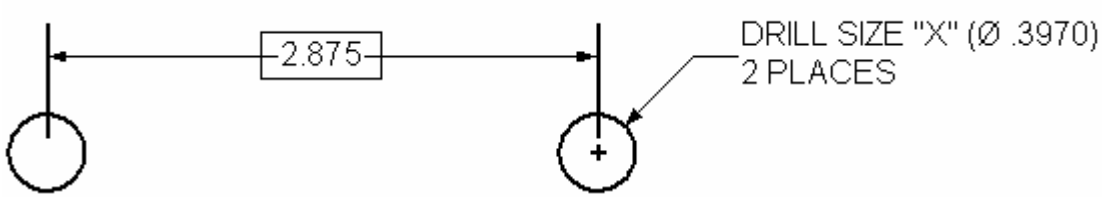

Figure 21: TABS6 Frame Mount Hole Pattern

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6.2 Wheel Speed Sensor Installation Requirements

See BW-120-A, Application Specification, "Wheel Speed Sensor Customer Interface Recommendations" for details.

6.2.1 Sensor Mounting Block

6.2.1.1 Material

The mounting block is typically made of steel or other ferro-magnetic material. If a different material is used, it must be analyzed for compatibility with the *Bendix*® clamping sleeve for the wheel speed sensor.

CAUTION:

- Sensor mounting blocks must be properly protected against corrosion.
- BCVS will not provide warranty for wheel speed sensors and/or clamping sleeves exhibiting corrosion sustained from sensor mounting blocks.

6.2.1.2 Dimensions

The mounting block must be 30.0 mm in length with an 18.0-18.11 mm diameter through-hole.

The block should not exceed 31.0 mm in length. A mounting block length less than 29-mm may not allow the sensor to seat properly.

The sensor block height must be chosen to allow the centerline of the sensor to be aligned with the center of the exciter ring.

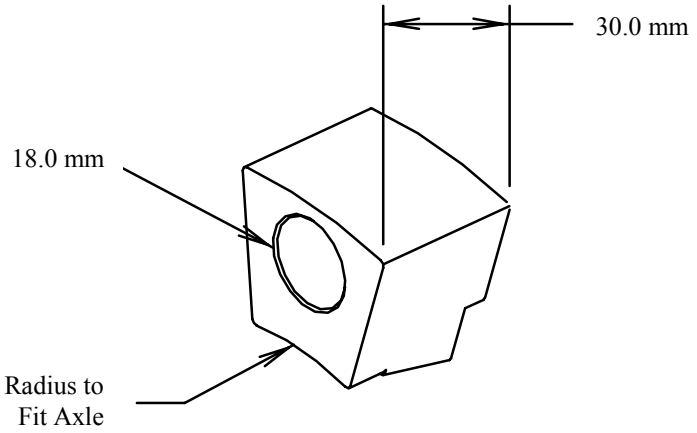

Figure 22: Wheel Speed Sensor Mounting Block

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6.2.1.3 Installation

The block is usually welded longitudinally along both sides to ensure long-term mounting security. The axle or vehicle manufacturer typically supplies the sensor-mounting block. The clamping sleeve or sensor must not be installed into the sensor-mounting block during the welding operation.

The mounting block face must be no more that 0.156 inches (4mm) from the installed location to the face of the exciter ring teeth and the axial alignment of the through-hole must be as close to perpendicular as possible. The exciter ring and sensor should be perpendicular to each other (within ½°). The height from the bottom of the block to the centerline of the hole must be such that the centerline of the sensor is aligned to the center of the exciter ring teeth.

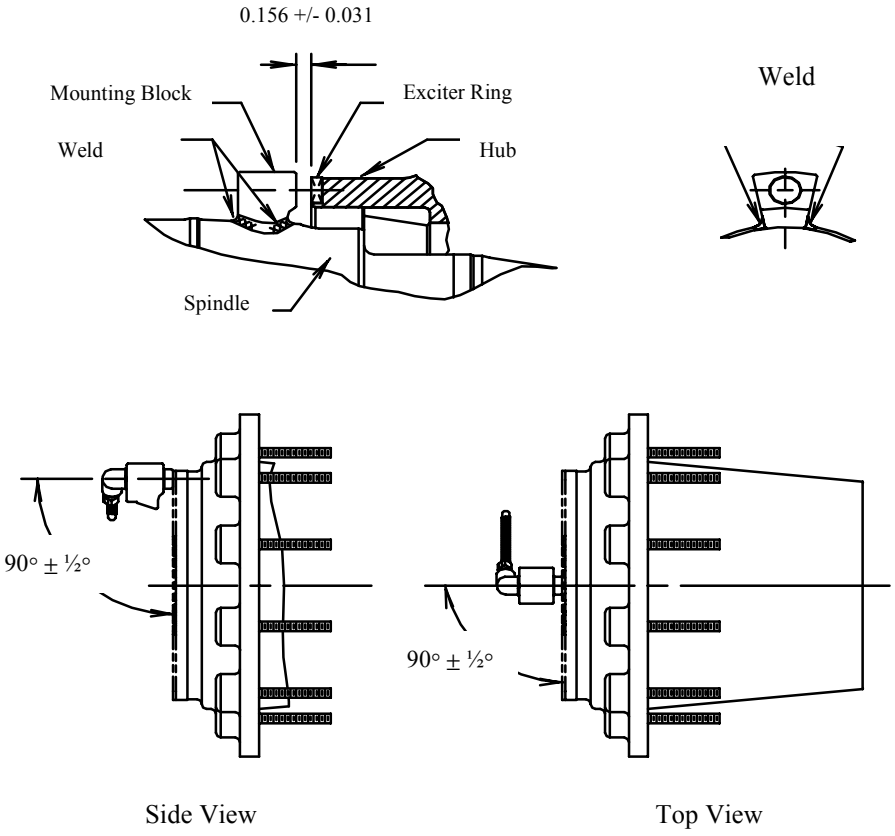

Figure 23: Wheel Speed Sensor Mounting Block Installation

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6.2.1.4 Preferred Wheel Speed Sensor Mounting Block Location

The preferred location for the sensor mounting block is between the 2 to 3 o'clock or 9 to 10 o'clock positions on the spindle. This location offers the highest resistance to wheel loading flexure and helps to maintain a uniform sensor to exciter ring air gap during vehicle use.

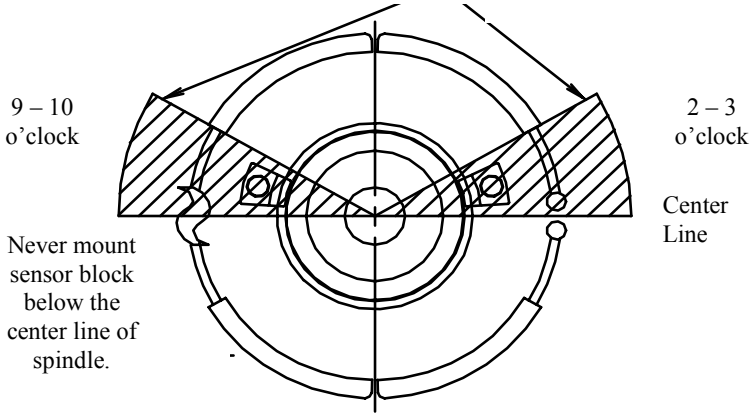

Figure 24: Preferred Wheel Speed Sensor Mounting Block Location

6.2.2 Wheel Speed Sensor Clamping Sleeve Installation

The wheel speed sensor clamping sleeve (*Bendix*® part number 5012878) is designed to firmly hold the wheel speed sensor in place while also allowing the sensor to adjust in position as the wheel and hub rotate. Wheel bearing play and heavily loaded axles will require sensors to self-adjust. Proper sensor installation begins by fully inserting the spring clip into the sensor block, keeping the retaining tabs toward the inside of the vehicle.

CAUTION:

- Any device used to hold the clamping sleeve in place must be properly protected against corrosion.
- BCVS may not provide warranty for wheel speed sensors and/or clamping sleeves exhibiting corrosion sustained from sensor mounting blocks or other devices.

6.2.3 Wheel Speed Sensor Installation

Lubricant may be applied to the inner diameter of the mounting block and/or to the sensor before installation. The sensor is then pushed into the clamping sleeve until it stops against the teeth of the exciter ring. Lubrication is not required for the installation of the sensor, but may be used.

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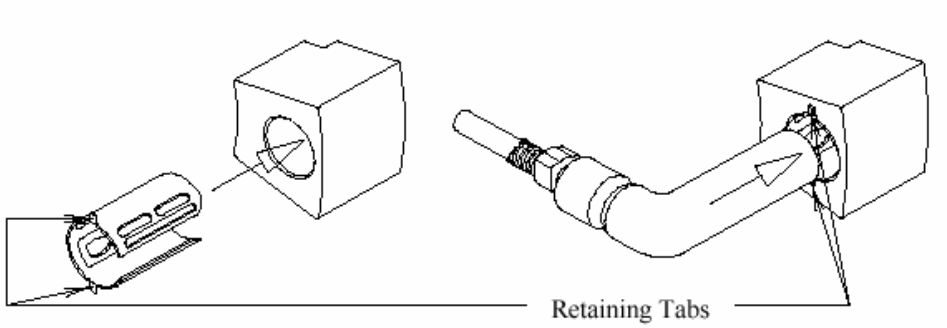

Figure 25: Sensor Clamping Sleeve and Sensor Installation

The wheel speed sensor must be utilized in applications where the minimum and maximum operating temperatures are not exceeded. See BW-260-PR for details.

CAUTION:

- Operation of the WS-24 outside of the operating temperature range is not guaranteed.
- BCVS may not provide warranty for WS-24 sensors used in applications outside of the operating temperature range.

6.2.4 Sensor Displacement Force

At 68ºF, the axial force needed to move the sensor when retained with a fully inserted wheel speed sensor clamping sleeve within the sensor mounting block is approximately 22 to 45 pounds (100 to 200N). Values less than 22 pounds could result in movement of the sensor and loss of ABS on that wheel.

6.2.5 Sensor Wiring Requirements

Proper routing and securing of sensor wiring is imperative for reliable system operation.

Sensor wiring coming out of the wheel ends must be routed away from moving brake components and secured to the axle to prevent excess cable length and wiring damage. When securing sensor wires to the axle, it is required that cable ties be installed to the sensor wire within 3 inches (76.2 mm) of the sensor head to provide strain relief.

Following the axle, the sensor wires must be attached along the length of the service brake hoses using cable ties with ultraviolet protection and securing the cable every 6 to 8 inches (152 to 203 mm). Sufficient – but not excessive -- cable length must be provided to permit full suspension travel and steering axle movement. Wires must be installed so that they cannot touch rotating elements such as wheels, brake discs or drive shafts. Radiation heat protection may be necessary in the area of brake discs.

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BCVS does not recommend using standard tie-wraps to secure wiring harnesses directly to rubber airlines. This can cause premature wiring failure from excessive expansion when air pressure is applied. Non-metallic hose clamps or bow-tie tie-wraps are preferred.

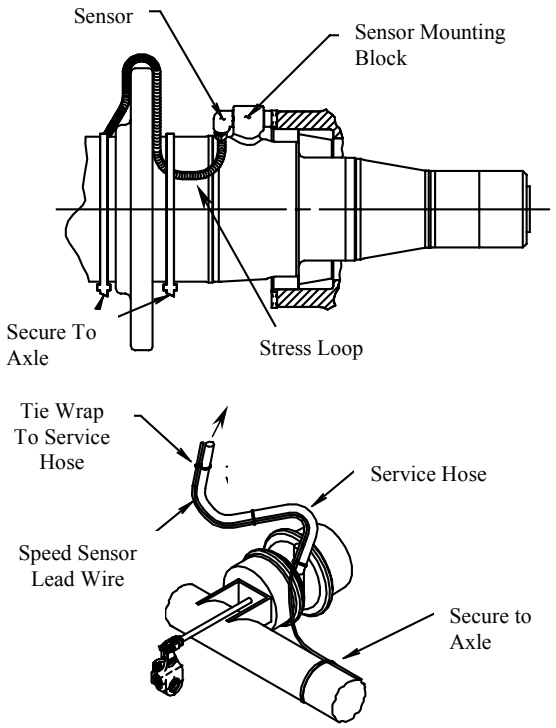

Figure 26: Wheel Speed Sensor Wire Routing

The use of grommets or other suitable protection whenever the cable must pass through metallic frame members is required.

All sensor wiring must utilize twisted pair wire, with approximately one to two twists per inch.

It is recommended that wires be routed straight out of a connector for a minimum of three inches before the wire is allowed to bend.

If convoluted tubing is used, its inside diameter must match the size of the wire bundle as closely as possible.

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CAUTION:

- Vehicle OEMs must insure that the unmated connectors are protected against paint spray during vehicle assembly.
- The sensor wire harness connectors must be properly seated with the seals intact and undamaged and the secondary locks snapped securely in place. Failure to do so could result in moisture or corrosion damage to the connector terminals. BCVS may not provide warranty for sensors displaying this condition.
- Follow all connector manufacturer requirements for the fabrication of all wire harnesses.
- Wire harness lengths must be carefully selected. Harnesses of excessive length increase the possibility of parasitic interference and wire damage. Harnesses that not long enough can cause the wire to break or can subject the wire to mechanical strain that in turn can lead to failure of the wire.
- Excess lengths of wire are not to be wound to form coils.

WARNING:

- All wires must be carefully routed to avoid contact with rotating elements.
- Wiring must be properly secured as described below using UV stabilized, non-metallic hose clamps or bow-tie cable ties to prevent pinching, binding or fraying.
- BCVS may not provide warranty coverage for sensors with damaged wiring.

6.3 Exciter Ring Installation Requirements

See BW-120-A, Application Specification, "Wheel Speed Sensor Customer Interface Recommendations" for details.

6.3.1 Material

The exciter ring material must be permeable and of low magnetic retentively. Examples of suitable exciter ring materials include machined, quenched and drawn steels.

6.3.2 Installation

Exciter rings are typically pressed on to the hub by the hub manufacturer.

If a wheel hub is not available with an exciter ring installed, an exciter ring may be purchased separately and pressed on to a properly prepared hub. A 0.004 inch (0.10mm) interference fit is required between the outer diameter of the machined hub surface and the inner diameter of the exciter ring[4]. It is important that this relationship is established and maintained under all operating conditions.

[4] If the exciter ring is made of powdered iron (sintered), consult the manufacturer for specific instructions on how to install this ring on to the hub.

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CAUTION:

- When altering the hub in any way, the owner assumes all warranty responsibility for the hub. All manufacturer warranties may be void.
- Contact the hub supplier for details.

The maximum axial run-out of the exciter ring must not exceed 0.008 inch (0.2mm).

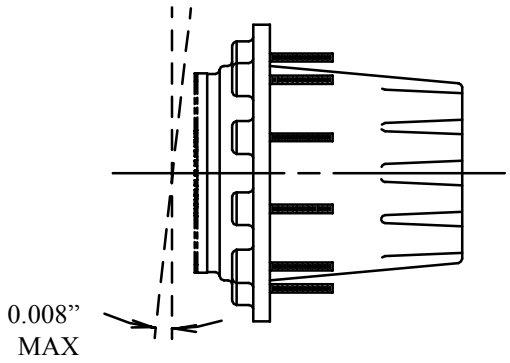

Figure 27: Maximum Exciter Ring Run-Out

6.3.3 Stamped Steel Exciter Ring

A well-designed and manufactured exciter ring produces a clean wheel speed signal. In this respect, a stamped steel exciter ring produces very good results since the teeth are defined by through-holes, and tooth definition (i.e. edge sharpness) is excellent. However, these types of rings are easily damaged before installation on the vehicle, so extra care is required to ensure that they are properly mounted and are running true.

6.3.4 Machined Steel

In the case of a steel exciter ring, the height of each tooth becomes important. Manufacturing considerations influence the solution and a tooth height of 0.078 inches (1.98mm) is common. To obtain a well-defined wheel speed signal, it is important that the sensor pole piece does not bridge the gap between one tooth and the next (nominally 0.078 inches/1.98mm). Magnetic flux saturation will occur and the signal will be degraded.

6.3.5 Oil Seals

Oil seals must clear the inside diameter of the exciter ring and must not extend beyond the face of the ring. Consult the hub supplier for further information.

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6.3.6 Exciter Ring Damage

At a minimum, replace the exciter ring if any of the following conditions are detected.

- Damaged, chipped or broken teeth
- Tooth height less than 0.050 inches (1.27 mm)
- Cracked exciter ring
- Rust on exciter ring
- Exciter ring loose on hub

6.4 Trailer ABS Warning Lamp

An acceptable indicator light (environmentally sealed, amber) can be obtained through Bendix or other suppliers. The trailer-mounted ABS warning lamp is powered from the TABS6 ECU. Bendix strongly recommends against the use of a trailer frame or chassis ground for the trailer-mounted ABS warning lamp.

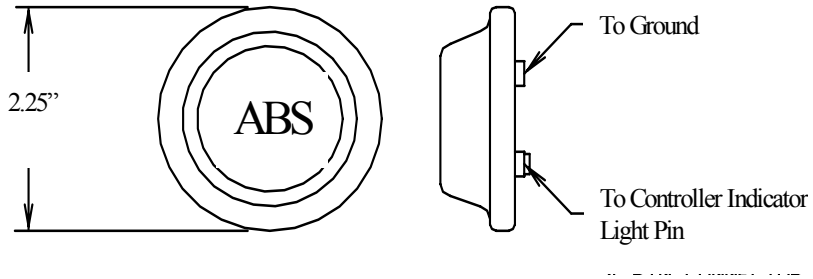

Figure 28: Trailer ABS Warning Lamp

Per FMVSS 121, the letters “ABS” must be molded, stamped, or otherwise marked on the lamp lens or its housing in letters not less than 10 mm (0.4 inches) high to identify the function of the lamp. For non-labeled lamps, an “ABS” label may be affixed to the trailer body or converter dolly. The letters for a non-labeled lamp are to no less than 25 mm (1 inch) high and not further than 150 mm (5.9 inches) from the edge of the lamp lens.

6.4.1 Trailer Lamp Location

Per FMVSS 121, the ABS warning lamp must be mounted on the left side of the trailer as viewed from the rear. In addition, the lamp is to be no closer than 150 mm (5.9 inches) and no further than 600 mm (23.6 inches) from the rear-side, red marker lamp.

6.4.2 Dolly Lamp Location

Per FMVSS 121, each trailer converter dolly should be equipped with a lamp mounted on the permanent structure of the dolly. The lamp is not to be less than 375 mm (14.8 inches) above the road surface when measured from the center of the lamp with the dolly at curb weight. When a person standing 3 meters (9.8 feet) from the lamp, view the lamp from a perspective perpendicular to the vehicle’s centerline, no portion of the lamp should be obscured by any structure on the dolly.

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6.5 Trailer ABS Wiring Details

Trailer manufactures are recommended to provide a minimum of 9.5VDC to the trailer ABS unit through both the brake light power circuit and the ignition power circuit to ensure adequate power is available for trailer ABS needs. See TMC RP-141 for more details.

The power, ground and ABS warning lamp wiring is typically integrated into the trailer chassis wiring harness at the OEM. However, retrofit and some small OEM installations will require these wires to be added to the trailer system. Wire size must be selected based on ABS active power needs and the length of the vehicle. When using add-on power and ground wires, the power and ground connections should be made as close to the nose of the trailer as possible. Bendix strongly recommends against the use of a trailer frame or chassis ground for the ABS unit or trailer-mounted ABS warning lamp. Power and ground wiring should be disconnected while performing any welding on the vehicle.

Circuit	7-Pin Trailer Electrical Connector	5-Pin ABS Power Connector	Standard TABS6 5-Pin ECU Connector	Premium TABS6 18-Pin ECU Connector
Ignition Power (PLC) (Blue Wire)	Pin 7	B	Pin B	Pin 6
Brake Light Power (Red Wire)	Pin 4	A	Pin A	Pin 12
Ground (White Wire)	Pin 1	E	Pin E	Pin 18
Warning Lamp (White/Green Wire)	N/A	D	Pin D	Pin 5

Table 16: Trailer ABS Wiring Requirements

6.5.1 Power from Tractor

Trailer manufactures are recommended to provide a minimum of 12.5 VDC with a 10A load on the ignition wire at the front of the trailer. The tractor must also provide sufficient brake light power to the trailer as a back up to the ignition power. See TMC RP 137A for more details.

6.5.2 Warning Lamp Wiring

It is recommended to use 16 gauge wire or larger for the warning lamp circuit. The warning lamp is powered via the TABS6 ECU. Ground must be provided to the lamp using an individual ground wire. It is not recommended to use chassis ground since this can promote failure of the warning lamp due to corrosion.

6.5.3 Twisted Pair

Wheel speed, modulator and data wires must be twisted conductors to reduce any influence of electrical noise. At least one twist per inch is recommended.

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6.5.4 Connectors

All connectors must be securely connected to prevent environmental contamination or damage. All ABS electrical connectors should be greased for added protection against corrosion. If a connector is not joined to its mate or otherwise left exposed during the painting of the trailer, damage could be done to the connector. Tape, or other means of protection, must be used to assure the connector does not become contaminated. Refer to Section 3.2 for the standard connectors that are used with the TABS6 Trailer ABS system.

6.5.5 Routing and Securing of Wires

Once assembled, all wheel speed sensor cables, power, ground and warning light connections must be properly restrained to prevent wire and connector damage.

Fastening the pigtail harness leads to the control line, less than 12 inches from the TABS6 connector provides strain relief. In addition to these tie-wraps, it is necessary that any additional wiring be secured at approximate 18 inch intervals throughout their length.

Speed sensor wiring coming out of the wheel ends should be routed away from moving brake components and secured to the axle to prevent excess cable length and wiring damage. The sensor wires should be secured along the service brake hoses leading to the TABS6 ECU pigtail. The stress loop allows the sensor to properly adjust but not to be pulled out of adjustment.

Bendix does not recommend using standard tie-wraps to secure wiring harnesses directly to rubber airlines. This can cause premature wiring failure from excessive expansion when air pressure is applied. Non-metallic hose clamps or bow tie tie-wraps are preferred.

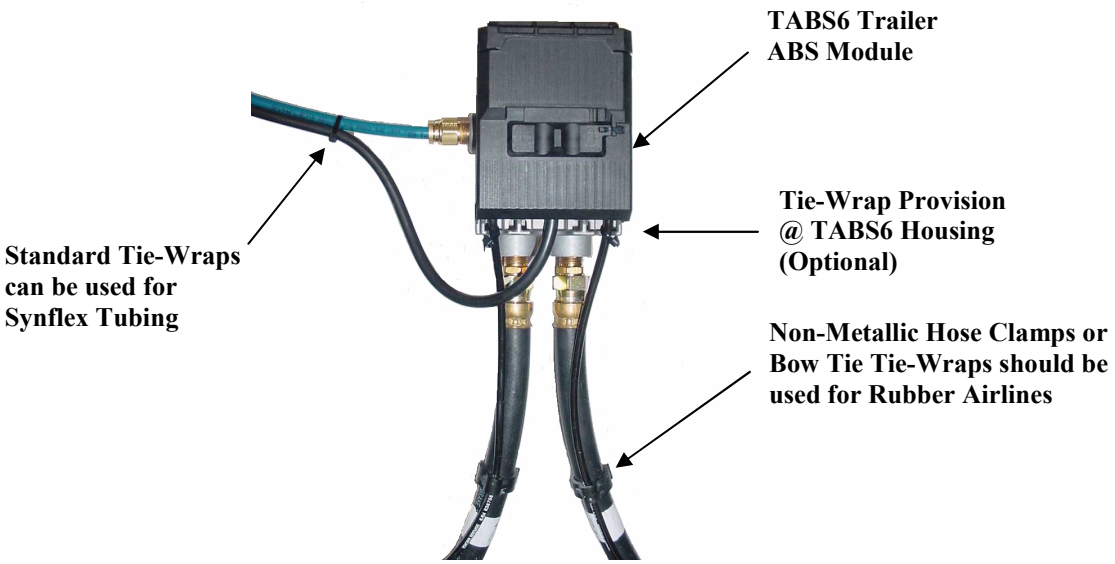
TABS6 Trailer ABS Module
Tie-Wrap Provision @ TABS6 Housing (Optional)
Standard Tie-Wraps can be used for Synflex Tubing
Non-Metallic Hose Clamps or Bow Tie Tie-Wraps should be used for Rubber Airlines

Figure 29: Trailer ABS Routing & Securing of Wire Harnesses

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6.6 OEM End-of-Line (EOL) Testing

System installation should be verified by the vehicle manufacturer through the performance of an End-of-Line (EOL) test.

This test should include, but is not limited to, the following:

1) Verification of the TABS6 ECU information:
   a) ECU type
   b) Part number
   c) ABS configuration
   d) Tire size
   e) Presence of existing faults
2) Verification of the correct installation of all wheel speed sensors. This must include sensor location, and verification of sensor output.
3) Verification of the proper operation of the trailer-mounted ABS warning lamp.
4) Verification of an acceptable PLC signal is present on the ignition power line for proper operation of the in-dash (PLC) ABS warning lamp.
5) Verification of the correct installation of all MRVs. This must include MRV location, and proper wiring between the ECU and the MRV (hold and release wires not reversed on a MRV, for example).
6) Verification of proper battery voltage and ground inputs to the TABS6 ECU.
7) Inputting of Scratch Pad data:
   a) OEM name
   b) Plant location
   c) VIN
   d) EOL date and time
   e) Vehicle manufacturing date
   f) Technician

The vehicle OEM should clear the active and inactive fault memory of the TABS6 ECU at the end of the EOL test, and verify that no faults exist.

It is recommended that the vehicle OEM saves a report of each EOL test performed for future reference.

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7 Antilock application check list

This checklist is provided to assist in the verification of the ABS installation. It remains the responsibility of the vehicle manufacturer to ensure system performance through the performance of an EOL test.

Trailer ABS System Configuration			
• Is the correct Trailer ABS ECU(s) selected for the specific trailer application? (e.g. 4S/2M axle control for full trailer)	☐ Yes	☐ No	☐ Don't Know
Trailer ABS Assembly (ECU/Modulator Relay Valve)			
• Is the location of the assembly such that will not be subjected to direct wheel spray?	☐ Yes	☐ No	☐ Don't Know
• Is the location of the assembly such that will not be subjected to temperatures less than -40 °F or greater +185 °F?	☐ Yes	☐ No	☐ Don't Know
• Is the exhaust port of the assembly facing in a downward direction?	☐ Yes	☐ No	☐ Don't Know
• Is the exhaust port of the assembly unobstructed with significant free space below (> 1 inch)?	☐ Yes	☐ No	☐ Don't Know
• Were all tube / brake hose fittings installed per the recommended manufacture's specification?	☐ Yes	☐ No	☐ Don't Know
• Are all unused delivery ports of the assembly plugged?	☐ Yes	☐ No	☐ Don't Know
• For reservoir-mounted installations:			
– Is a heavy gauge steel nipple (Schedule 80) being used between the assembly's supply port and the reservoir?	☐ Yes	☐ No	☐ Don't Know
– Were following torque specifications used when installing pipe nipples? ▪ Finger tight plus 1-1/2 turns with thread sealant ▪ Finger tight plus 2 turns without thread sealant	☐ Yes	☐ No	☐ Don't Know
• For frame-mounted installation:			
– Were the mounting fasteners torque's per the recommended manufacture's specification?	☐ Yes	☐ No	☐ Don't Know
– Is a minimum 5/8" tube fitting being used for the assembly's supply port?	☐ Yes	☐ No	☐ Don't Know
Remote Modulator Relay Valve			
• Is the location of the assembly such that will not be subjected to direct wheel spray?	☐ Yes	☐ No	☐ Don't Know
• Is the location of the assembly such that will not be subjected to temperatures less than -40 °F or greater +185 °F?	☐ Yes	☐ No	☐ Don't Know
• Is the exhaust port of the assembly facing in a downward direction?	☐ Yes	☐ No	☐ Don't Know
• Is the exhaust port of the assembly unobstructed with significant free space below (> 1 inch)?	☐ Yes	☐ No	☐ Don't Know
• Were all tube / brake hose fittings installed per the recommended manufacture's specification?	☐ Yes	☐ No	☐ Don't Know
• Are all unused delivery ports of the assembly plugged?	☐ Yes	☐ No	☐ Don't Know
• For reservoir-mounted installations:			
– Is a heavy gauge steel nipple (Schedule 80) being used between the assembly's supply port and the reservoir?	☐ Yes	☐ No	☐ Don't Know
– Were following torque specifications used when installing pipe nipples? ▪ Finger tight plus 1-1/2 turns with thread sealant ▪ Finger tight plus 2 turns without thread sealant	☐ Yes	☐ No	☐ Don't Know
• For frame-mounted installation:			
– Were the mounting fasteners torque's per the recommended manufacture's specification?	☐ Yes	☐ No	☐ Don't Know
– Is a minimum 5/8" tube fitting being used for the assembly's supply port?	☐ Yes	☐ No	☐ Don't Know

Table 17: TABS6 OEM Application Check-List

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Wheel Speed Sensor Placement			
• Has the correct axle been chosen to place the wheel speed sensors? Trailer Suspension — Wheel Speed Sensor Placement 2 Axle Spring — Forward Axle 2 Axle Air — Rear Axle 3 Axle Spring — Forward & Rear Axles 3 Axle Air — Center & Rear Axles	☐ Yes	☐ No	☐ Don't Know
Exciter Ring			
• Are the exciter rings made out of an acceptable material? (permeable and of low magnetic retentive)	☐ Yes	☐ No	☐ Don't Know
• Do the exciter rings contain 100 teeth?	☐ Yes	☐ No	☐ Don't Know
• Are the teeth undamaged and well defined?	☐ Yes	☐ No	☐ Don't Know
• Are the teeth the proper width so that the sensor pole piece does not bridge the gap between teeth?	☐ Yes	☐ No	☐ Don't Know
• Do the exciter rings contain the correct tooth height? (typically 1.98 mm)	☐ Yes	☐ No	☐ Don't Know
• Do the oil seals clear the I.D. of the exciter rings and not extend beyond the face of the ring?	☐ Yes	☐ No	☐ Don't Know
• Are the exciter rings properly mounted to the hubs? – Exciter ring is tight and does not slip (minimum interference fit of 0.004" required). – With properly adjusted wheel bearings, axial run-out does not exceed ± 0.008".	☐ Yes	☐ No	☐ Don't Know
Sensor Mounting Block			
• Are the dimensions of the mounting block correct? (length 29.0 mm to 31.0 mm; through-hole Ø18.0 to 18.11 mm)	☐ Yes	☐ No	☐ Don't Know
• Are the mounting blocks properly welded to the spindle? (face <4 mm to the face of the exciter ring teeth; within ½° of perpendicular to the exciter ring)	☐ Yes	☐ No	☐ Don't Know
• Does the sensor block height allow the centerline of the sensor to be aligned properly with the exciter ring?	☐ Yes	☐ No	☐ Don't Know
• Are the mounting blocks mounted above the centerline of the spindle?	☐ Yes	☐ No	☐ Don't Know
• Are the mounting blocks installed in the preferred location? (between 2 to 3 o'clock or 9 to 10:00 o'clock for least effect from axle flexing during loading)	☐ Yes	☐ No	☐ Don't Know
• Are the mounting blocks properly protected against corrosion?	☐ Yes	☐ No	☐ Don't Know
Wheel Speed Sensor Clip			
• Are the correct clamping sleeves (Bendix part number 5012878) being used?	☐ Yes	☐ No	☐ Don't Know
• Are the clamping sleeves fully inserted into the sensor mounting blocks, with the tabs away from the wheel?	☐ Yes	☐ No	☐ Don't Know

Table 17: TABS6 OEM Application Checklist (Cont.)

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Wheel Speed Sensor			
• Has lubricant been applied to the I.D. of the mounting blocks and/or the sensors	☐ Yes	☐ No	☐ Don't Know
• Have all sensors been installed completely pressed against the exciter ring?	☐ Yes	☐ No	☐ Don't Know
• After rotating the wheel, is there a sensor gap of 0.020 in. or less? (If not, check for excessive wheel bearing play or tone ring run-out)	☐ Yes	☐ No	☐ Don't Know
• When rotating the wheel, do all sensors have acceptable signal output of 0.25 VAC @ 0.5 RPS?	☐ Yes	☐ No	☐ Don't Know
• Are the sensors being installed in an area not subjected to temperatures outside of their operating range?			
• Are the sensor wiring coming out of the wheel ends routed away from moving brake components and secured to the axle to prevent wiring damage?	☐ Yes	☐ No	☐ Don't Know
• Are the sensor wires secured along the service brake hoses leading to the ECU unit every 12 inches?	☐ Yes	☐ No	☐ Don't Know
• Are all wiring secured by UV-stabilized, non-metallic hose clamps, or bow tie cables ties?	☐ Yes	☐ No	☐ Don't Know
ABS Warning Lamp			
• Has a good ground been provided for the ABS warning lamp on the vehicle?	☐ Yes	☐ No	☐ Don't Know
• Are the letters "ABS" embossed on the lam7p lens or on a label next to the lamp?	☐ Yes	☐ No	☐ Don't Know
• <u>For trailer installations:</u> – As per FMVSS 121, is the ABS warning lamp mounted on the left side of the trailer as viewed from the rear, no closer than 150 mm (5.9 inches), and no further than 600 mm (23.6 inches) from the red rear side marker lamp?	☐ Yes	☐ No	☐ Don't Know
• <u>For trailer converter dolly installations:</u> – As per FMVSS 121, is the ABS warning lamp mounted on the permanent structure of the dolly so that the lamp is not less than 375 mm (14.8 inches) above the road surface when measured from the center of the lamp with the dolly at curb weight?	☐ Yes	☐ No	☐ Don't Know
– Is the lamp positioned such that it is not obscured by any structure on the dolly?	☐ Yes	☐ No	☐ Don't Know
Pneumatic System Plumbing			
• Are all fittings/brake hoses installed in the ports of the air brake system components with the proper torque?	☐ Yes	☐ No	☐ Don't Know
• Are all air tubing and hoses marked properly per FMVSS 106?	☐ Yes	☐ No	☐ Don't Know
• Is the air tubing harnesses mounted away from the rail, above the lower flange, and supported with standoff clamps?	☐ Yes	☐ No	☐ Don't Know
• Have all air tubing and hoses been inspected to verify no kinks or restrictions?	☐ Yes	☐ No	☐ Don't Know
• Are all air tubing and hoses routed to allow adequate clearance from moving components (suspension, etc.)?	☐ Yes	☐ No	☐ Don't Know
• Is the modulator relay valve(s) plumbed correctly? (supply line to supply port, control line to control port, delivery line from delivery port)	☐ Yes	☐ No	☐ Don't Know
• Has the air system and plumbing been verified with the appropriate Bendix system schematic (if applicable)?	☐ Yes	☐ No	☐ Don't Know
• With the system fully charged and with a full brake application, has the trailer air brake system checked to verify that there are no leaks?	☐ Yes	☐ No	☐ Don't Know
• Does the trailer air brake system meet the brake application and release timing requirements of FMVSS 121?	☐ Yes	☐ No	☐ Don't Know

Table 17: TABS6 OEM Application Checklist (Cont.)

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Electrical System Wiring			
• Has a moderate amount of nonconductive electrical grease been applied to each connector pin before installation?	☐ Yes	☐ No	☐ Don't Know
• Are all connectors completely latched and seated?	☐ Yes	☐ No	☐ Don't Know
• Are the connections tight, clean, and protected against moisture?	☐ Yes	☐ No	☐ Don't Know
• Are all connectors protected against paint spray?	☐ Yes	☐ No	☐ Don't Know
• Is the wire harness the proper length?	☐ Yes	☐ No	☐ Don't Know
• Are the wheel speed sensors connected to the correct pigtail harness lead? (Incorrect sensor installation may cause a fault Indication or degraded ABS performance)	☐ Yes	☐ No	☐ Don't Know
• For multi-channel ABS systems, is the remote modulator relay valve connected to the correct pigtail harness lead? (Incorrect modulator installation may cause a fault Indication or degraded ABS performance)	☐ Yes	☐ No	☐ Don't Know
• Are wires permitted to come straight out of all connectors for a minimum of 3 inches before bending?	☐ Yes	☐ No	☐ Don't Know
• Is all wiring carefully routed to allow adequate clearance from moving components (suspension, etc.)?	☐ Yes	☐ No	☐ Don't Know
• Is wiring routed away from all sharp edges?	☐ Yes	☐ No	☐ Don't Know
• If the wire harness is routed through a frame member, are grommets used to prevent chaffing?			
• Is excess wire properly secured (not wound to form coils)?	☐ Yes	☐ No	☐ Don't Know
• Are all wire harnesses secured every 18 inches?	☐ Yes	☐ No	☐ Don't Know
• Are all wiring secured by UV-stabilized, non-metallic hose clamps, or bow tie cables ties?	☐ Yes	☐ No	☐ Don't Know
Trailer ABS System Check-Out			
• Specific Trailer ABS Tests: (Refer to the Bendix Trailer ABS Service Data Sheets for diagnostic and configuration information)			
– With power applied to the trailer (constant ignition and/or brake lamp), does the trailer-mounted and the tractor in-dash (PLC) ABS warning lamp illuminate for 2.5 seconds "ON" as a bulb check and then turn "OFF"? (if the lamp stays "ON", check for faults)	☐ Yes	☐ No	☐ Don't Know
– With a trailer brake application and power applied to the trailer (constant ignition and/or brake lamp), do the modulator relay valves perform a Chuff Test to indicate proper installation and function?	☐ Yes	☐ No	☐ Don't Know
– Has the Trailer ABS ECU auto-configured to the correct ABS configuration?	☐ Yes	☐ No	☐ Don't Know
– Does the Trailer ABS ECU perform ABS as expected? (Road test in safe area, making an abrupt stop from about 20 MPH to check for proper function. The wheels should not enter a prolonged lock condition and ABS function should be audible)	☐ Yes	☐ No	☐ Don't Know

Table 17: TABS6 OEM Application Checklist (Cont.)

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8 Applications

8.1 Range of Application

The TABS6 is available in a number of different configuration and control modes to suit a variety of trailer needs. Figure 30 provides examples of how TABS6 can be used in different applications.

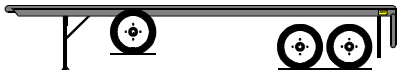
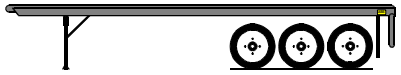
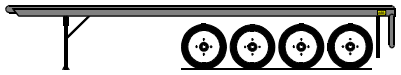
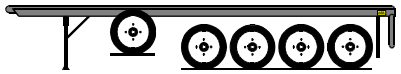
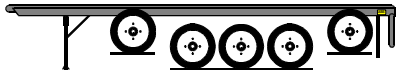
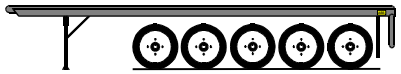
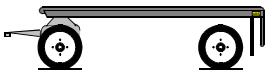
Trailer Application	2S/1M		2S/2M		4S/2M		4S/3M
	Dolly	Axle	Side	Axle	Side	Axle	Side/Axle
		(1) or	(1)				
		(1) or	(1) or		(1)		
						(1) or	(1)
					(1)	or	(1)
					(1)	or	(1)
			(1) and				(1)
						(1) and	(1)
					(1)	and	(1)
						(1) or	(1)
	(1)						

Figure 30: ABS System Application Chart

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8.2 Special Considerations

8.2.1 Spring Brake Control Valve (SR-5)

For trailers or dollies using spring brakes for the emergency brake function, a spring brake control valve is required. The TABS6 Trailer ABS will generally function with spring brake valves from other manufacturers, however the Bendix SR-5 trailer spring brake control valve is recommended. See BW-196-PR for details regarding the SR-5 trailer spring brake valve.

The SR-5 is designed to be tank mounted. Rotate the entire assembly into the service tank port until secure and upright. A wrench may be used on the nipple fitting to drive it into the tank port. Over-torquing of the nipple fitting could cause damage to the valve body.

8.2.2 Non-Spring Brake Emergency Function

The DC-4 and TR-3 combination can be used to provide emergency brake function when installed according to the figure below. Mount these valves directly to the trailer frame rail or crossmember using the appropriate hardware. Mounting holes may need to be drilled at the mounting location.

8.2.3 Choosing The Axle To Place Wheel Speed Sensors

If any axle is to be controlled by the TABS6 but not sensed, the wheel speed sensors are typically located on the axle that tends to unload or lighten during braking. The standard convention for sensor placement in this case is shown in the following chart. However, due to variations in trailer suspension designs, this convention is not correct for all applications. For more information on locating the wheel speed sensors, contact Bendix or refer to the vehicle or suspension manufacturer.

Choosing The Axle To Place Wheel Speed Sensors	
Trailer Suspension	**Wheel Speed Sensor Placement**
2 Axle Spring	Forward Axle
2 Axle Air	Rear Axle
3 Axle Spring	Forward and Rear Axles
3 Axle Air	Center and Rear Axles

Figure 31: Wheel Speed Sensor Placement

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8.3 Application Diagrams

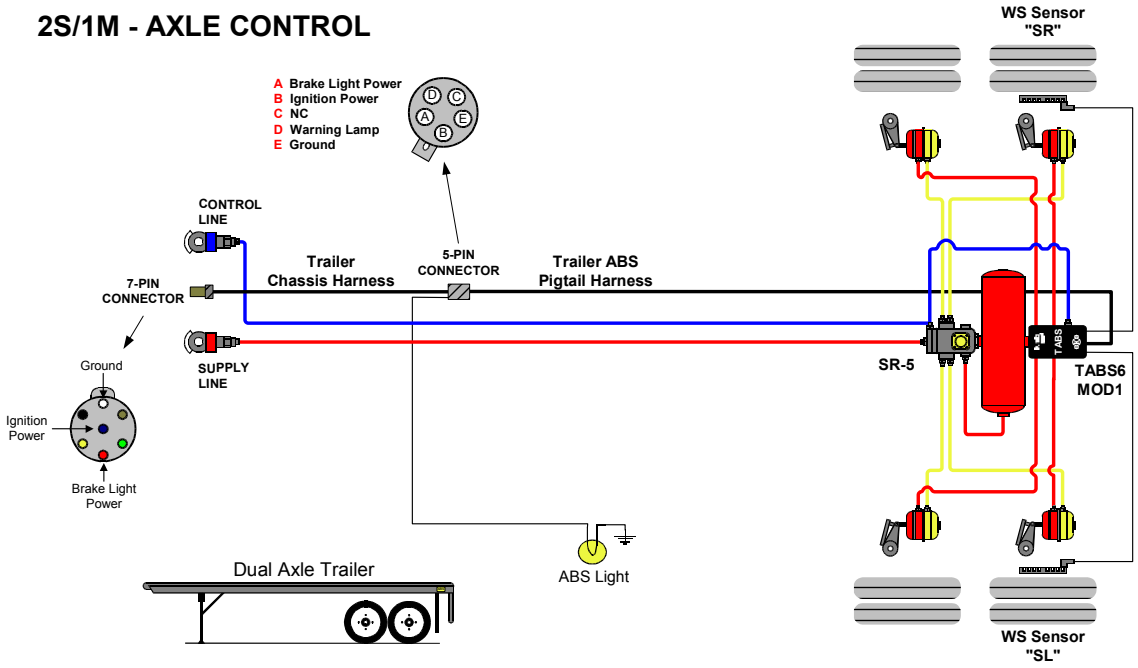

Figure 32: Typical 2S-1M Axle Control ABS Electrical and Air System

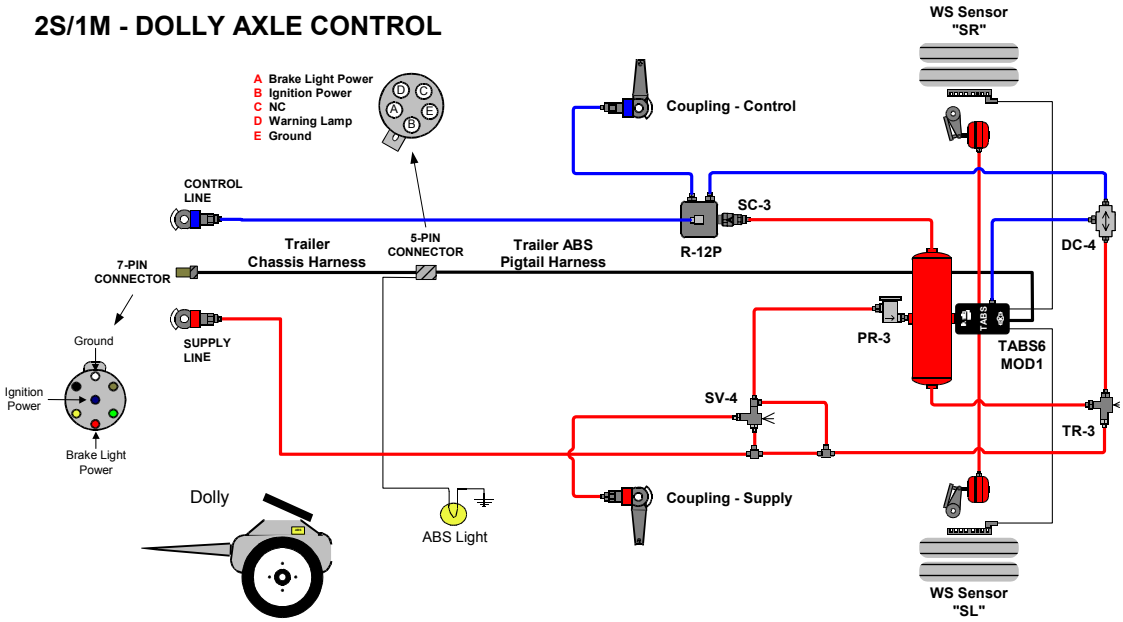

Figure 33: Typical 2S-1M Dolly-Axle Control ABS Electrical and Air System

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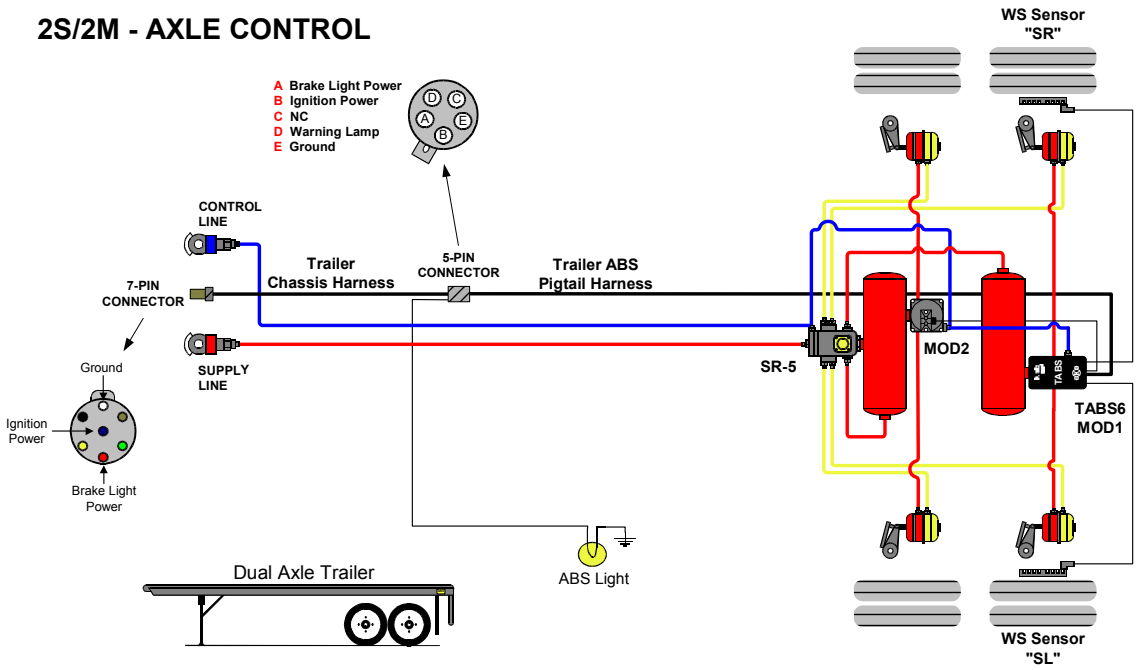

Figure 34: Typical 2S-2M Axle Control ABS Electrical and Air System

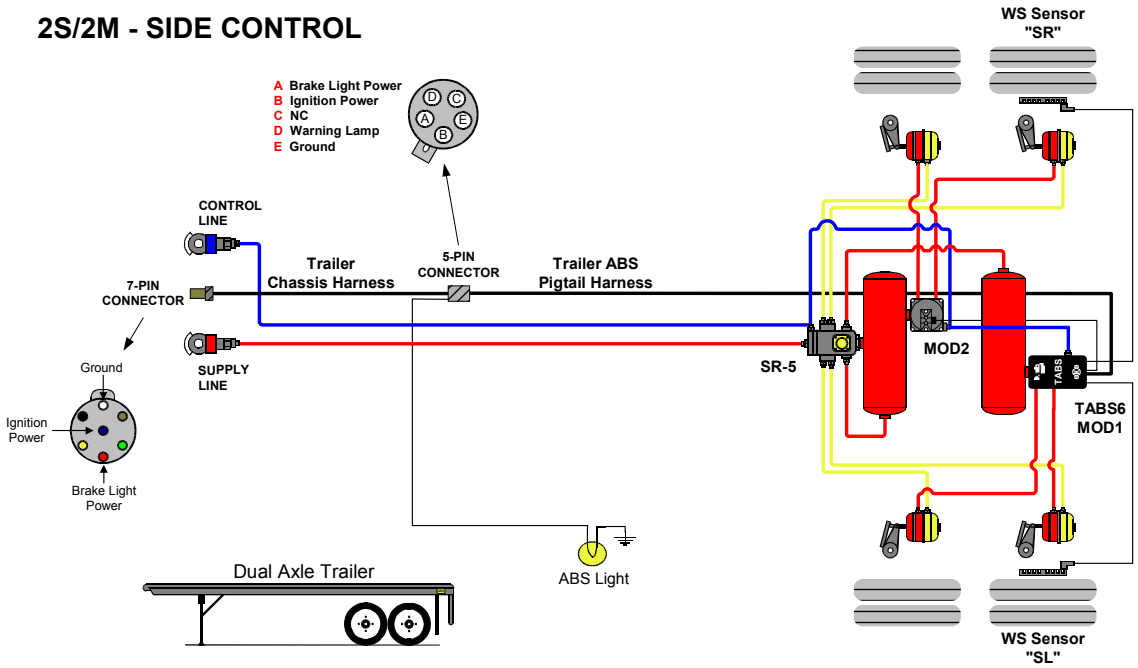

Figure 35: Typical 2S-2M Side Control ABS Electrical and Air System

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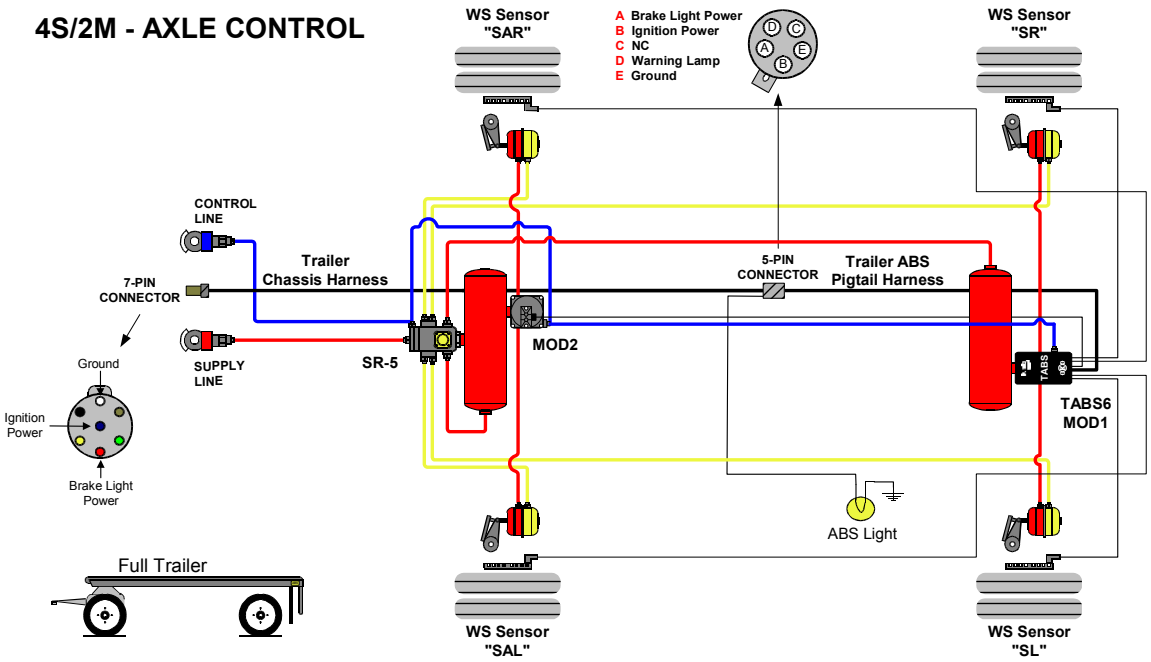

Figure 36: Typical 4S-2M Axle Control ABS Electrical and Air System

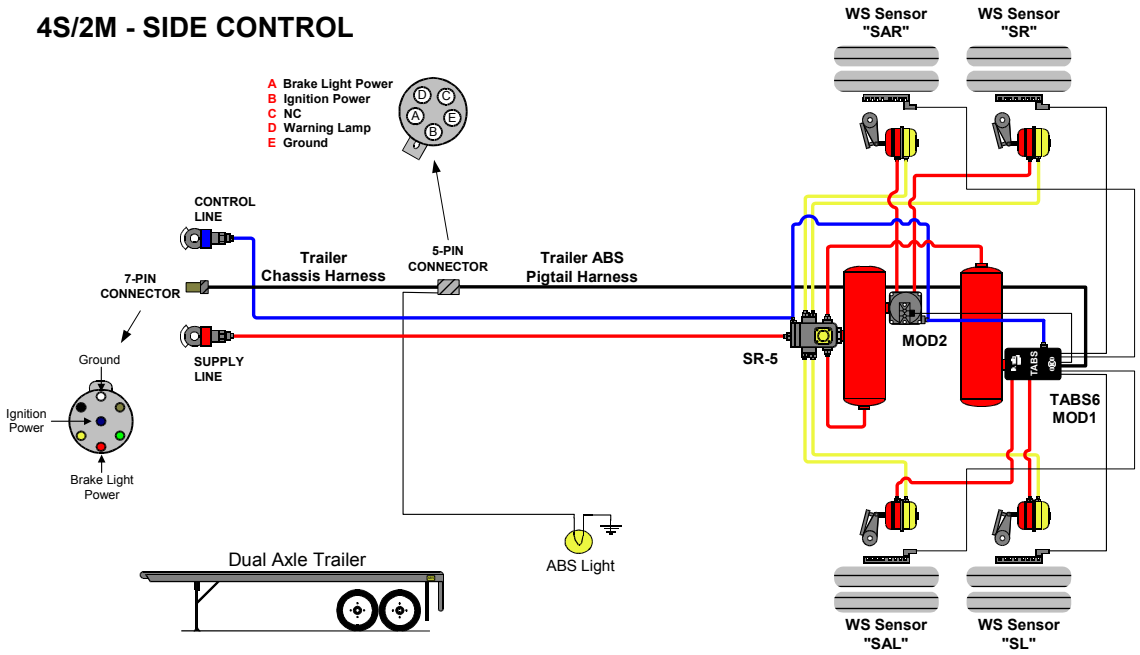

Figure 37: Typical 4S-2M Side Control ABS Electrical and Air System

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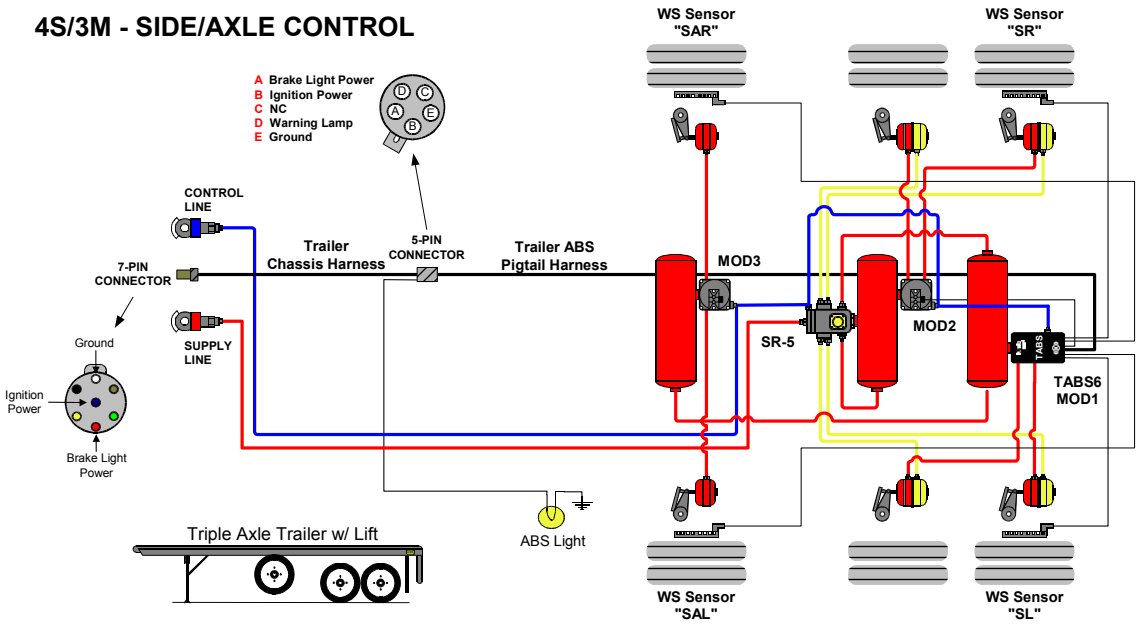

Figure 38: Typical 4S-3M Side/Axle Control ABS Electrical and Air System

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